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WAR MACHINE

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How Hollow Charges Work



Tank Killers

A fully illustrated guide to Infantry Anti-Tank Weapons of World War II

WAR MACHINE

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Infantry Anti-Tank Weapons of World War II

Modern infantry are equipped with man-portable anti-tank weapons capable of dealing with any armour at a respectable range. The infantry of World War II were not so fortunate: anti-tank guns were bulky and scarce, and hand-held weapons were in their infancy. Nevertheless, these primitive short-range weapons began to evolve into a genuine defence against tanks.

Despite the success of the anti-tank gun during World War II, many tanks were destroyed in action by a diversity of other weapon types, often having little in common with each other except the fact that they had been developed to destroy enemy tanks. The range of these weapons was wide during World War II, varying from the bizarre Soviet dog mines to many variations of the hollow-charge warhead. As will be related, these varied in delivery method from being hand-thrown to rocket-propelled.

Nearly all the weapons described in this assessment were relatively short-range weapons. They therefore came into the domain of the foot soldier rather than the gunner, and it was the infantry which was the genre's main operator. This included the array of anti-tank rifles that were in service when World War II started, though few were still in use when 1945 came around. The anti-tank rifles were perhaps a minor class of their own, but it would be difficult to define weapons such as the Panzerfaust and Panzerwurfmine in any category other than that of anti-tank weapon. In their day both were fearfully effective weapons, but today they have virtually passed from use (although relations of the Panzerfaust can still be encountered). The anti-tank grenade has also virtually disappeared, and so too has the suicide tank killer made infamous by the Japanese in 1944 and 1945. But modern relatives of the bazooka and the Raketenpanzerbüchse can still be found in widespread

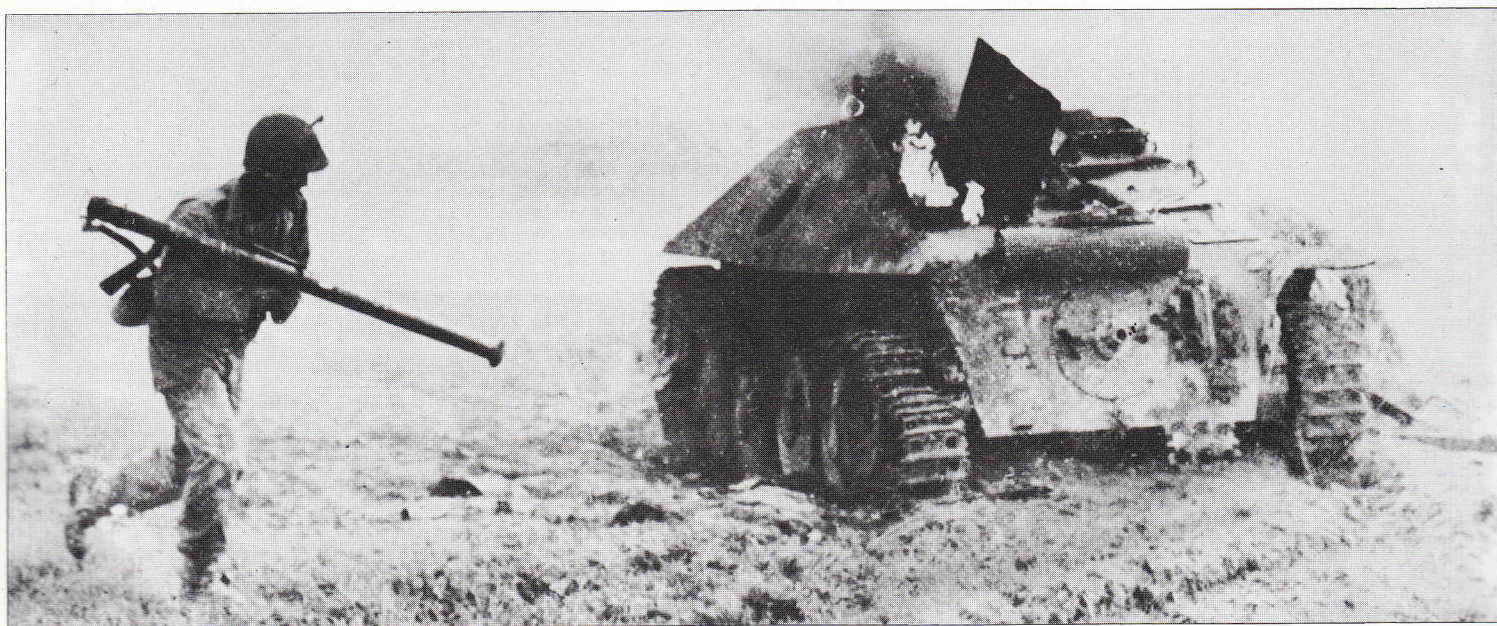
use, and the Molotov cocktail is still a weapon favoured by many irregular armed forces, to say nothing of terrorists of every shade.

Being mostly close-range weapons, the anti-tank methods mentioned in this assessment became very personal weapons. None of them would have been of any use whatsoever without the personal application and determination of their users, and as always this is an important factor to be borne in mind when reading of them. It still evokes a considerable degree of admiration to consider how the British Home Guard trained to tackle the expected invading German tanks and even more to consider how the Soviet partisans risked their lives to repel the German invaders. Consideration of the various forms of Japanese suicide methods may produce differing reactions, but the fact remains that the men who went out to destroy tanks and die in the process were essentially brave men, even if their psychology is still difficult to understand. All the weapons in these pages were essentially very personal ones, and perhaps even the Red Army soldiers grew attached to the dogs who carried their mines.

An American soldier runs past a German Jagdpanzer 38(t) Hetzer that he has just knocked out using his 2.36-in (60-mm) Rocket Launcher M1 'bazooka'. The bazooka came as a nasty surprise to the Germans when it was first used in Tunisia in 1943, and they soon set about copying the basic idea for their own use.



A British Army PIAT team is shown emplaced near Caen in June 1944. The PIAT normally had a two-man team, one to fire and one to carry the ammunition and load the bombs into the launching trough. To be fully effective the PIAT had to be used at really close ranges.





USA

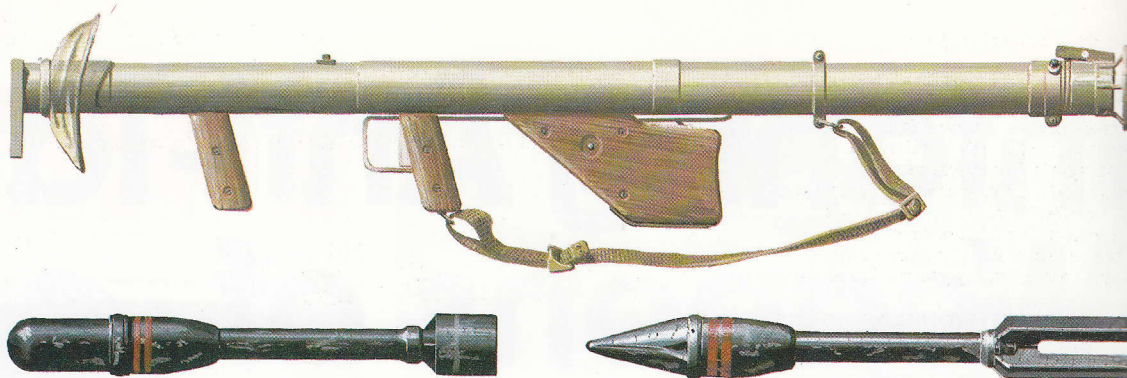
Bazooka

The American **bazooka** was one of the more original weapons of World War II and was founded on basic rocket research that had been conducted at Aberdeen Proving Ground, Maryland, since 1933. The active service development of the weapon began in earnest in early 1942 and the first of them went into action in North Africa in November 1942, although it was the following year before any were used against Axis armour. The full designation of the first model was **2.36-in Rocket Launcher, M1**. The rocket fired was the **M6A3** and the practice rocket was known as the **M7A3**.

The bazooka was a very simple weapon, being nothing more than a steel tube (open at both ends) through which the rocket was launched. A shoulder rest or wooden stock was provided along with two grips for aiming; the rear grip included the trigger group. The rocket was fired electrically and in low temperatures not all the propellant was consumed before the rocket left the launcher, allowing unburnt powder to be blasted into the firer's face. To prevent this it was possible to fit a small circular wire mesh screen just behind the muzzle. In practice the bazooka could be used at point targets up to 274 m (300 yards) away, but for most purposes range was confined to about 91 m (100 yards).

Soon after the M1 bazooka entered service it was replaced by the essentially similar **M1A1**. It was a popular weapon that could knock out any enemy tank and was normally served by a two-man team, one aiming and the other loading the rockets and connecting their electrical firing circuits. The bazooka soon found a great number of battlefield tasks other than use against tanks: it was very good at knocking out pillboxes of all kinds, and could even blast holes through barbed-wire obstacles; it could be used at area targets such as vehicle parks at ranges up to 594 m (650 yards), and at times was also used to clear combat lanes through minefields; and there are records of the bazooka being used against artillery pieces at close ranges.

But it was against tanks that the bazooka made its main mark, and it was seized upon by the Germans as the design basis for their Raketenpan-



Above: The American 2.36 in (60 mm) Rocket Launcher M1 was the first of the bazookas and was used by the Germans as the original for their RP series. The M1 used a 'one-piece' barrel that could not fold and early versions (shown here) used a wire mesh shield around the muzzle to protect against rocket blast.



The original M1 bazooka is shown on the left and the M9 on the right. The M9 could be broken down into two halves, which greatly assisted carrying and stowage inside vehicles. By the time the war ended a version of the M9 was being produced in aluminium for lightness; this was the M18.

zerbüchse series after examples of the M1 had been captured in Tunisia in early 1943. Although the German counterparts were much larger in calibre, the Americans stuck to their 60-mm (2.36-in) calibre until after 1945. By then they had introduced a new model, the **M9** which differed from the M1 in being able to be broken down into two halves for ease of carrying. Smoke and incendiary rockets were de-

veloped and used before 1945, although much of their use was confined to the Pacific theatre. As the war ended the all-aluminium **M18** launchers were being introduced into service.

By the time the war ended no less than 476,628 bazookas of all types had been produced, along with 15,603,000 rockets of all kinds.

Specification

M1A1

Calibre: 60 mm (2.36 in)
Length: 1.384 m (4 ft 6.5 in)
Weights: launcher 6.01 kg (13.25 lb); rocket 1.54 kg (3.4 lb)
Range: maximum 594 m (650 yards)
Muzzle velocity: 82.3 m (270 ft) per second
Armour penetration: 119.4 mm (4.7 in) at 0°



USSR

Soviet anti-tank rifles

The Red Army used two types of anti-tank rifle during World War II, both of them very distinctive for they were long and powerful rifles that both fired the same 14.5-mm (0.57-in) ammunition. For some reason the Soviet armed forces had neglected the anti-tank rifle when other nations were just adopting the weapon, and only introduced the type into use at a time when other nations were busy discarding theirs. Set against this it must be said that the Soviet rifles were much more viable weapons than most in use at the time.

The more numerous of the Soviet anti-tank rifles was the **PTRD 1941**, a weapon produced by the Degtyarov design bureau and introduced in mid-1941, just in time for the German invasion of the Soviet Union. The **PTRD-41** (as it was often known) was a very long weapon that was nearly all barrel and equipped with a semi-automatic breech mechanism. It could penetrate

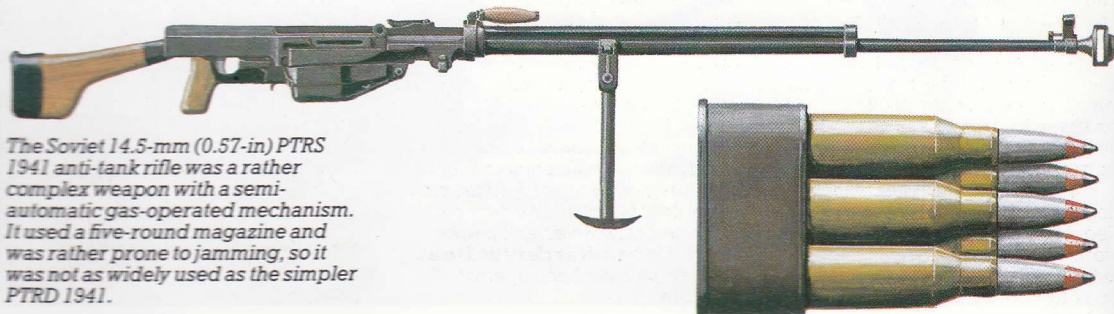
up to 25 mm (0.98 in) of armour at 500 m (547 yards) and fired either steel or tungsten-cored projectiles. A large muzzle brake was fitted and a bipod under the barrel steadied the rifle in use.

The second anti-tank rifle was the **PTRS 1941** or **PTRS-41**, a product of the Simonov design bureau. Compared

with the PTRD-41 it was a heavier and more complex weapon, but it fired the same ammunition and had an identical performance. The main change with the PTRS-41 was the use of a gas-operated mechanism and the addition of a five-round magazine. At the time these combined to make the PTRS-41 a more trouble-prone weapon than the

simpler and lighter PTRD-41. Further complexity was added by a feature that allowed the barrel to be removed from the weapon for ease in carrying.

Despite the fact that these two anti-tank rifles arrived in Red Army service at a time when their anti-armour capabilities were being reduced by a rapid increase in German tank armour thick-



The Soviet 14.5-mm (0.57-in) PTRS 1941 anti-tank rifle was a rather complex weapon with a semi-automatic gas-operated mechanism. It used a five-round magazine and was rather prone to jamming, so it was not as widely used as the simpler PTRD 1941.

The Soviet PTRD 1941 fired the same steel-cored ammunition as the more complex PTRS 1941. It fired single shots only, but used a semi-automatic breech. It was widely used by the Red Army and partisans, and even the Germans used captured examples to arm garrison units. It was used for many years after 1945.

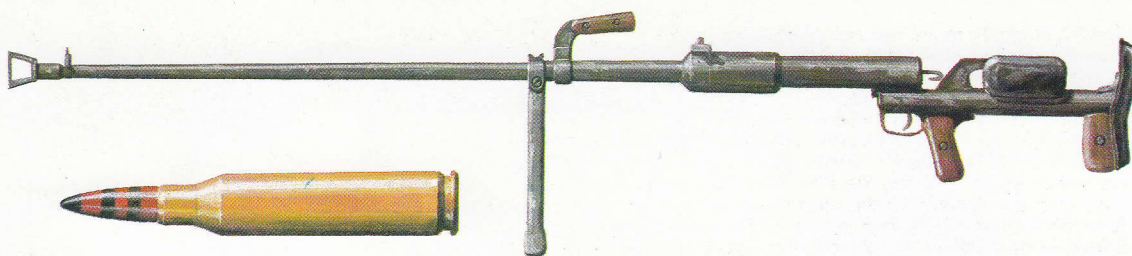
nesses, they remained in service until well after 1945; indeed, some were encountered in use by the Communist Chinese during the Korean War. For several reasons the Red Army found the PTRD-41 and PTRS-41 to be very useful all-round weapons: they were still useful against soft-skin targets such as trucks, and in house-to-house fighting they were unhandy but very powerful weapons; despite their length and weight they were very useful partisan weapons that could be easily carried by two men; and when opportunity arose the Red Army even used these rifles against low-flying aircraft. Some light armoured cars carried these rifles as their main armament and Lend-Lease vehicles such as Universal Carriers often mounted one.

The Red Army was not the only World War II operator of these anti-tank rifles, for the Germans pressed into their own use any that they could capture during the early stages of their campaign against the Soviet Union: they knew the PTRD-41 as the 14.5-mm *Panzerabwehrbüchse 783(r)* and the PTRS-41 as the 14.5-mm *Panzerabwehrbüchse 784(r)*. Few of them remained in German front-line use after 1943.

Specification

PTRD-41

Calibre: 14.5 mm (0.57 in)



The Soviet 14.5-mm (0.57-in) PTRD 1941 anti-tank rifle has had a round loaded into the breech with the loader's left hand; a subsequent tap on the firer's helmet would then indicate that the rifle is ready to fire.

Lengths: overall 2.02 m (6 ft 7.5 in);
barrel 1.35 m (4 ft 5.1 in)
Weight: 17.3 kg (38.14 lb)
Muzzle velocity: 1010 m (3,314 ft) per
second
Armour penetration: 25 mm (0.98 in) at

500 m (547 yards)

PTRS-41

Calibre: 14.5 mm (0.57 in)
Lengths: overall 2.108 m (6 ft 11 in);
barrel 1.216 m (3 ft 11.9 in)

Weight: 20.9 kg (46.1 lb)
Muzzle velocity: 1010 m (3,314 ft) per
second
Armour penetration: 25 mm (0.98 in) at
500 m (547 yards)



USSR

Soviet dog mines

In common with many other European armies, the Red Army maintained a number of 'war dogs' for various military purposes such as sniffing out explosives or even delivering messages and medical supplies in front-line areas, but there can have been few roles more bizarre for dogs to play than the Soviet dog mines that were used for a short period during World War II. Exactly how the idea of using dogs as mobile anti-tank mines came about has yet to be determined, but the idea was simple and seemed to offer great things for the hard-pressed Soviet forces during 1942.

The basic idea of the dog mine was that the dogs were trained to dive under enemy tanks whenever they appeared. Each dog carried on its back a wooden box (or packets secured to its body by a harness) and from the top of the box (or packets) protruded a vertical wooden post. When this post was pushed back-wards as the dog moved under the tank it detonated the explosives contained in the box (or packets) to the detriment of the tank and the unfortunate dog. Some accounts talk of wire sensors in place of the wooden post.

For all its simplicity the idea of the dog mines did not last very long. The Red Army soon discovered that there were two main disadvantages to the idea. One was that in order to train the dogs to dive under tanks they were

always given food under a tank. This was all very well, but to most dogs the familiar smells and sights under a Soviet tank were very different to those under German tanks. Thus in a battlefield situation once they were released with the explosives attached the dogs often tended to make for the familiar smells and sounds of Soviet tanks rather than the intended German tanks, with obvious results. The second snag was that the Germans soon learned of the Soviet *Hundminen* and spread the word through the efficient German military media machinery that all Soviet dogs likely to be encountered were rabid and were to be shot as soon as they were spotted. This alone caused the virtual disappearance of dogs all along the Eastern Front within a matter of days, making the further use of dog mines that much more unlikely. One other factor now seems obvious was that on any battlefield the noise and general chaos in progress would unhinge any normal dogs' behaviour, making them run amok in any direction other than to-

wards tanks of any kind, and so hazardous to anyone in their vicinity.

The Soviet dog mines did have a few successes, but their period of 'action' was short once their two-edged nature became apparent. The idea was not used after 1942, but there were some

reports of the Viet Minh attempting to use dog mines during the fighting in Indo-China during the late 1940s. Some reports on the Red Army after 1945 still contained references to the dog mines, no doubt just in case they were used again.

The Soviet dog mines seemed like a good idea when first mooted, but in use the dogs were easily distracted to friendly tanks, where their rod-operated explosive back-packs proved to be just as destructive as they would have been against German tanks.





GERMANY

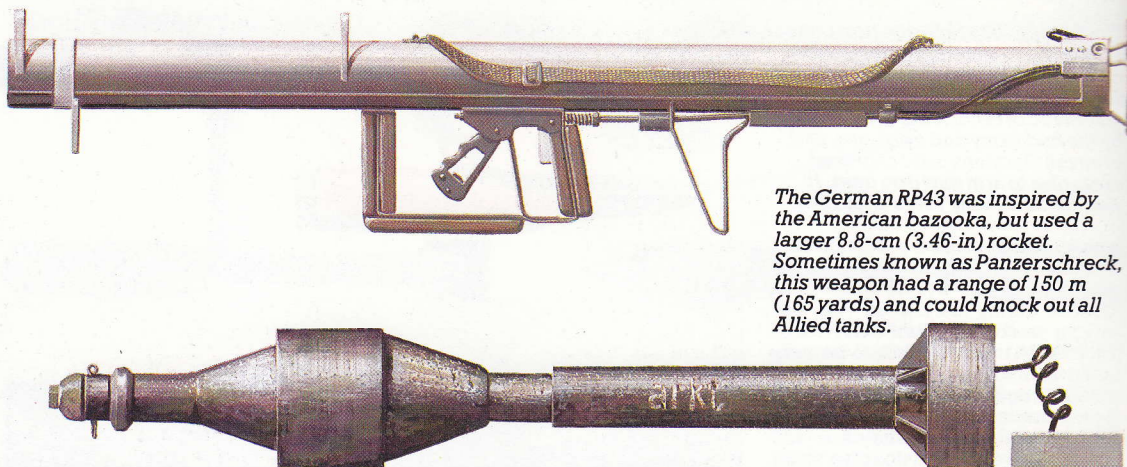
Raketenpanzerbüchse

In 1943 numbers of American 60-mm (2.36-in) M1 bazookas were captured in Tunisia and were rapidly examined by German technicians, who quickly appreciated that the simple and cheap construction of the rocket-launcher could be used to good advantage by the Germans themselves, and before very long the first German equivalents appeared. This German launcher fired a rocket very similar to that used on the Püppchen but was modified for electrical firing. This first German launcher was known as the **8.8-cm Raketenpanzerbüchse 43 (RPzB)** and was little more than a simple tube open at both ends, from which the rocket could be launched. The firer rested the 'pip' on his shoulder and operated a lever to power a small electrical generator. Releasing a trigger allowed the power so produced to be passed via wires to the rocket motor for firing. The weapon was completed by a simple sighting system.

The RPzB was an immediate success as an anti-tank weapon. Firing a larger rocket than the bazooka it had a better anti-armour capability, but the rocket was limited in range to about 150 m (164 yards). There was another disadvantage in that the rocket motor was still burning as it left the muzzle, so the user had to wear protective clothing and a gas mask to avoid being burnt. The rocket exhaust was dangerous for a distance up to 4 m (13.1 ft) to the rear of the tube on firing, and this exhaust could also kick up clouds of dust and debris to betray the firing position. This latter factor did little to endear the RPzB 43 to some users.

Further development produced the **RPzB 54**, which had a shield to protect the firer so that the protective clothing was no longer necessary, and the later **RPzB 54/1** fired a more developed rocket that required a shorter launching tube but which had a slightly increased range of 180 m (197 yards). The RPzB 54 and RPzB 54/1 replaced the earlier RPzB 43 in production, and the early models were passed to second-line and reserve formations.

These weapons soon became very widely distributed and used, to the extent that they were encountered on every front in large numbers. The later rockets could penetrate up to 160 mm (6.3 in) of tank armour, but they were essentially close-range weapons that required careful handling in action; special care had to be taken regarding the dangerous effects of the backblast



*The German RP43 was inspired by the American bazooka, but used a larger 8.8-cm (3.46-in) rocket. Sometimes known as **Panzerschreck**, this weapon had a range of 150 m (165 yards) and could knock out all Allied tanks.*



British troops examine a captured 8.8-cm (3.46-in) RP 54 in Normandy, July 1944. The shield can be seen, as can the main lever for the electrical generator used for firing; this looks like a large trigger under the tube. The RP 54/1 was essentially similar but used a shorter launching tube.

on firing. The usual crew for these weapons was two men, one aiming and the other loading the rockets and connecting the ignition wires to the launcher contacts. Tank targets often had to be 'stalked' for the crews to get within effective range, but if a hit was registered that tank was usually 'dead'. The only counter to the RPzB series was extra protection such as sandbags, track links or stand-off armour, along with the introduction of special tank-protection infantry squads that

travelled with the tanks.

The RPzB series had several nicknames, including **Ofenrohr** (oven chimney) and **Panzerschreck** (tank terror).

Specification RPzB 43

Calibre: 88 mm (3.46 in)
Weights: launcher 9.2 kg (20.3 lb); rocket 3.27 kg (7.21 lb); warhead 0.65 kg (1.43 lb)
Length: 1.638 m (5 ft 4.5 in)



An RP 54 about to be fired. The small shield was fitted to protect the firer from the back-blast of the rocket motor after firing; note that the loader behind is hiding his face for the same reason. The simple fixed foresight is just visible. Note also the webbing sling used for carrying.

Range: maximum 150 m (164 yards)

RPzB 54

Calibre: 88 mm (3.46 in)
Weights: with shield 11 kg (24.25 lb); rocket 3.25 kg (7.165 lb)
Length: 1.638 m (5 ft 4.5 in)
Range: maximum 150 m (164 yards)
Rate of fire: 4-5 rpm



GERMANY

Anti-tank grenades

The German army did not have any specialized hand-delivered anti-tank grenade other than the Panzerwurm, which came into a special category. Instead, when armour targets were contemplated it was a common practice to remove the throwing handles from a number of Stielgranate stick grenades and secure them with wire around the head of another Stielgranate complete with its handle. This combination of grenade warheads was known as a **geballte Ladung**, and could be used for a variety of purposes from demolishing strongpoints to disabling a tank.

For anti-tank use the Germans relied mainly on rifle grenades. The

chief type was fired from the standard Kar 98k service rifle muzzle using a device known as a Schiessbecker, which was a cup that could be secured to the muzzle using a lever locking device. This cup was grooved internally to correspond with grooves on the rifle grenade body so that on firing the grenade was given a twist to assist in-flight stabilization. There were several anti-tank grenades that could be fired from this device, and these differed in size and the amount of explosive payload carried but all had a maximum range of about 200 m (219 yards). They were relatively ineffective against most tank armour after 1940 but were retained in service simply because they could not

be replaced immediately with anything better, and because they also had a secondary use against personnel targets. For maximum accuracy a complex little bubble sight on the rifle had to be used for aiming, and this sight alone was somewhat costly.

However, in complexity and cost this rifle grenade system paled when compared with what was almost certainly one of the most useless of the many gadgets delivered to front-line soldiers. This was the 27-mm (1.063-in) **Kampfpistole**, a device developed from a standard signal pistol to fire tiny grenades. Continued development had turned the signal pistol into a rifled weapon equipped with a complex

bubble sight and a folding butt together with a range of grenades that varied from the ordinary high explosive to grenades that produced whistling sounds to warn of gas attack. Among them was a hollow-charge grenade for use against armour, but this was only just over 51 mm (2 in) long and contained a minuscule charge of TNT. This grenade could be launched to a maximum range of 90 m (98 yards), but even if it hit a target it could produce little if any damage on even the lightest armoured target. But this weapon system, known as the **Sturmpistole** in its fully developed state, was issued to front-line troops and probably goes down in history as the only

The Anti-Tank Mine

Tens of millions of mines were buried during World War II, and most were laid to block or channel the movement of enemy tanks. Powerful anti-tank mines, detonated by the weight of a vehicle, were soon surrounded by anti-personnel devices to make the minefield hazardous to clear.

The first anti-tank mines appeared during the latter stages of World War I, when the tank had finally made its impression on the tactics of the day. These first mines were often artillery shells fitted with a rudimentary pressure fuse, but by late 1918 the first specially-produced anti-tank mines were in use by the German army.

In the years between the world wars the anti-tank mine appeared to lapse into obscurity, although most treatises on tank warfare made passing reference to them. It was not until the late 1930s that thought was given actually to producing them in any quantities, and well to the fore in this sphere were the German army and the Red Army.

The early anti-tank mines produced in these countries were simple devices: circular metal cases fitted with a form of pressure plate and fuse on top, and containing a quantity of explosive. They relied on blast effect alone to blow off a tank track or blast a way through thin protection to 'kill' the tank. The pressure system was so arranged that it could be actuated only by the weight of a tank so that infantry could march over the mines without detonating them, but this made the task of enemy mine-clearance teams so much easier that anti-tank minefields were usually scattered liberally with smaller anti-personnel mines that could be triggered by the weight of a man or even by the touching of a sensitive sensor rod or wire.

Typical of these early anti-tank mines were the German Tellermine. There were several models of these, including the initial Tellermine 29, two types of Tellermine 35, the Tellermine 42 and Tellermine 43. To quote figures, the Tellermine 42 had a diameter of 324 mm (12.76 in), a height of 102 mm (4 in)

and a weight of 7.8 kg (17.2 lb). It was filled with Amatol and was set off by a pressure of 340 kg (750 lb). As the war progressed the Tellermine grew more sophisticated: to prevent lifting by the enemy they were fitted with anti-handling devices and booby traps such as concealed explosive charges or anti-personnel mines. The main changes between the models, however, were production expedients to permit increased numbers of mines to be churned out, for the Germans used such weapons by the million. The Tellermine were widely used, but had a disadvantage in that their steel bodies could be easily discovered by the use of metal detectors. The Germans then undertook the development and production of various forms of anti-tank mine using non-metallic materials for the mine bodies. Glass, wood and various forms of plastic were all used, and the same materials were also used by the Soviets.

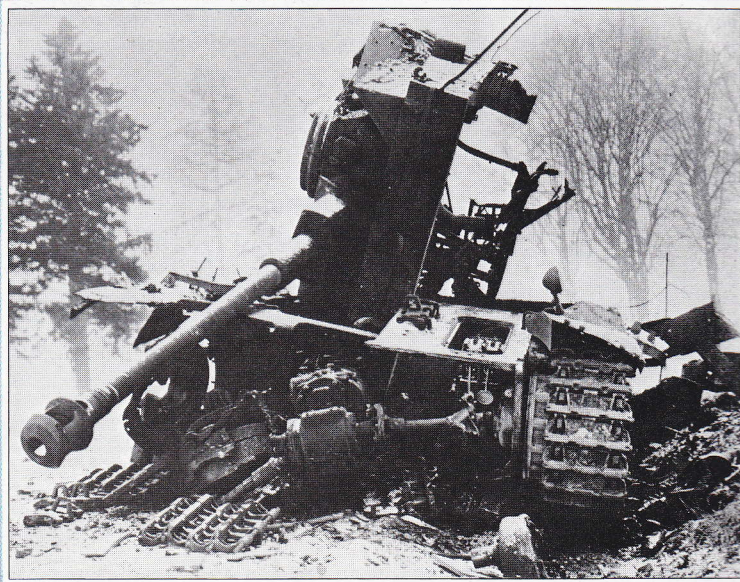
Typical of the early Soviet anti-tank mines was the Model 1938 which was a square-bodied mine containing 3.6 kg (7.94 lb) of TNT. It was typical of many Soviet mines of the period, but was soon supplemented by non-metallic mines, the Soviets making much use of wood in anti-tank mines, some of very simple construction and with even simpler detonating devices. Glass bottles were sometimes used in a manner similar to the Molotov cocktail but containing explosives.

The British army had few anti-tank mines to hand when the war started in 1939 other than the No. 75 or Hawkins Grenade, which was meant for use as an anti-tank mine as well as being a grenade. Later in the war some metal-cased mines were produced in large numbers, especially for use in the North African terrain where mines of all kinds were used in immense numbers.

The Americans concentrated their efforts on producing only one type of anti-tank mine, the M1. This mine used a 'spider' type of pressure plate that could pick up the pressure footprint of a tank over a wider area than most contemporary types of mine, which used small central pressure sensors. So widespread was the use of the M1 that many American vehicles had special racks to carry the mines. They also had a very long service life, for some even appeared during the 1982 Falkland Islands campaign.



A British Sapper clears an anti-tank Tellermine 42. Visible underneath is a Schützenmine, or 'S'-mine, that was secured to the Tellermine to explode if any unwary attempt was made to lift it. These 'S'-mines were either tied to the mine above or used a pressure device held down by the Tellermine.



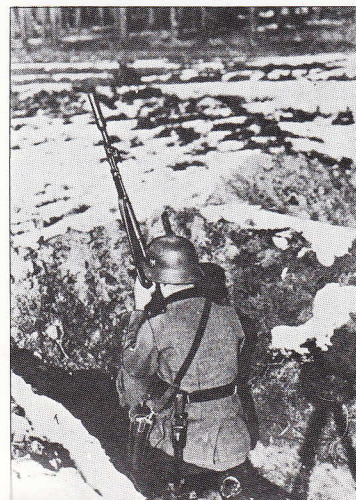
The effect of an anti-tank mine on a German PzKpfw IV. The mine appears to have detonated under the tank's right-hand track with the force of the explosion reaching the ammunition under the turret basket to detonate that as well, hence lifting the tank turret and killing the crew outright.

anti-tank pistol ever issued for service.

By the time World War II ended the range of grenades fired from the rifle Schiessbecker launcher cup included the **Gewehr Panzergrenate**, **gross Panzergranaat 46** and **gross Panzergranaat 61**. By then the Schiessbecker range had been increased by the introduction of a number of Panzerbüchse 39 anti-tank rifles modified into grenade-launchers by the addition of a launcher cup to their muzzles. This type was known as the **Grenatbüchse 39** and fired the entire range of German rifle grenades.

Right: A demonstration of the correct way to fire the Kar 98k fitted with a Schiessbecker grenade launcher. The grenades were launched using a special ballistite cartridge with the butt resting on the ground to take the substantial recoil forces. Aiming was rudimentary and range very limited.

Far right: The soldier in the doorway is armed with a Kar 98k rifle fitted with a Schiessbecker grenade launcher attached to the muzzle. This launcher fired an array of spin-stabilized grenades including some relatively ineffective anti-tank grenades using hollow charge warheads.





GERMANY

Püppchen

Once the Germans had appreciated that the artillery projectile was not the most efficient manner of delivering hollow-charge warheads to an armoured target (it moved too fast for the hollow-charge to have full effect), they moved towards the rocket as a delivery system. They produced a small rocket with a calibre of 8.8 cm (3.46 in) with a hollow-charge warhead that was quite sufficient to penetrate any known armour on any Allied tank, and then set about producing a launching system.

At that stage of rocket development the German designers appear to have had little experience of what a rocket-launcher should be like, and in the end they developed what was to all intents and purposes a small artillery piece to 'fire' the rocket. This device was known as the **Püppchen** (dolly), or more formally as the **8.8-cm Raketenwerfer 43**, and it had all the

appearances of a small gun. There was a shield and the launcher was moved on wheels. Once in position the wheels could be removed to lower the silhouette and the weapon then rested on rockers. The rocket was even loaded using a conventional breech mechanism. Where the Püppchen differed from artillery pieces was that there was no recoil mechanism. The recoil forces produced by firing the rocket were absorbed by the mass of the carriage alone, and the aimer could point the launcher tube by using a twin-handled grip and looking along the barrel.

The Püppchen was introduced into service in 1943, and in use had a maximum range of about 700 m (766 yards), though for anti-tank use the maximum effective range was about 230 m (252 yards) as the sighting system was rather rudimentary and the time of flight of the rocket could be measured

in seconds. It was possible to fire up to 10 rockets per minute. Other design features of the Püppchen were that it could be broken down into seven loads for pack transport, and that skis could be used for movement over snow. There were even instructions printed on the inside of the shield for untrained personnel to use it on a battlefield.

The Püppchen did not last very long in production. Almost as soon as the first items had been issued American bazookas were captured in Tunisia and examined by German technical personnel, who soon realized that the simple pipe was all that was needed to launch their 8.8-cm rocket and that the complexity of the Püppchen was unnecessary. Thus production ceased almost as soon as it started, and was then concentrated instead on the simple RPzB series. But those Püppchen equipments that had been made and

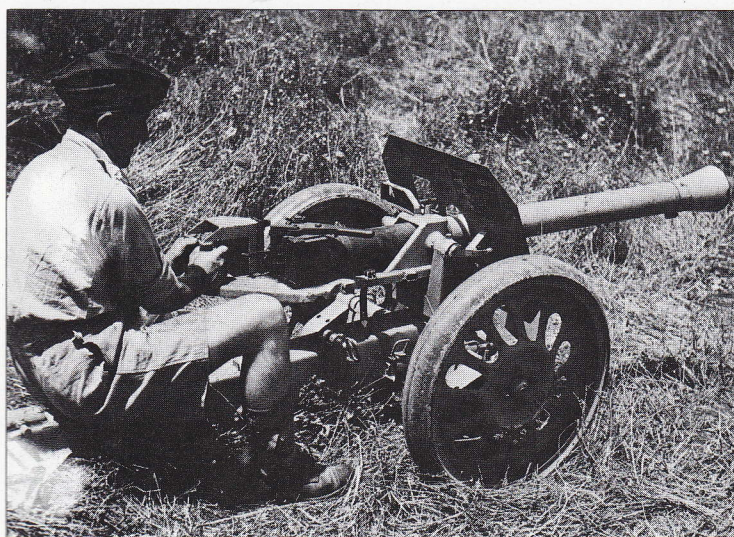
issued were not wasted. They were retained in use until the war ended, especially in Italy where a sizeable number were captured by the Allies and were subjected to close investigation by intelligence and technical staffs.

There were apparently intentions to mount modified Püppchen equipments on light armoured vehicles but none of these plans came to anything.

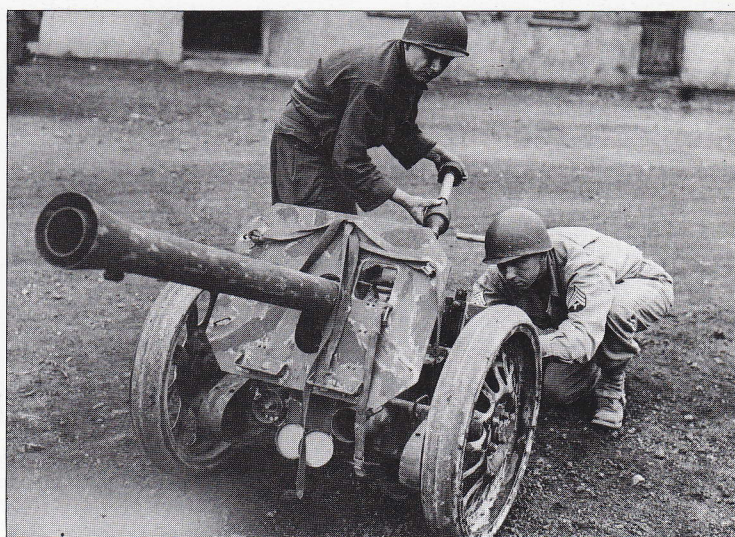
Specification

Püppchen

Calibre: 88 mm (3.46 in)
Lengths: overall 2.87 m (9 ft 5 in); barrel 1.60 m (5 ft 3 in)
Weights: travelling 146 kg (322 lb); in action 100 kg (220 lb); rocket 2.66 kg (5.86 lb)
Elevation: -18° to +15°
Traverse: 60°
Ranges: maximum 700 m (766 yards); anti-tank 230 m (252 yards)



A British soldier demonstrates a Püppchen captured in Tunisia in 1943, clearly showing its low silhouette. This rocket launcher had no recoil mechanism and used a simple breech, but compared with the RP 43 series it was much more complex and expensive to produce. The wheels could be removed if required.



The 8.8-cm (3.46-in) Raketenwerfer 43 or 'Püppchen' was a form of anti-tank rocket launcher that was superseded almost as soon as it entered service in 1943 by the RP 43 series firing a very similar rocket. The RP 43 could be produced far more cheaply and quickly than the Püppchen, here being examined by Americans.



GERMANY

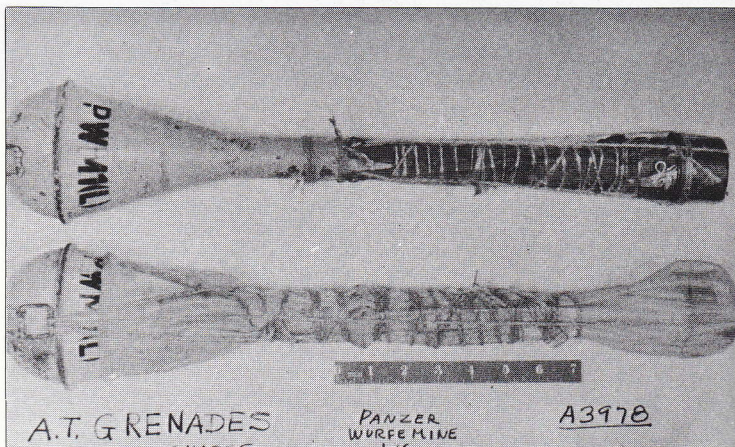
Panzerwurfmine (L)

The **Panzerwurfmine (L)** was developed by the German army for use by special tank-killer infantry squads to provide them with a powerful stand-off weapon that could be carried and used by one man. It was a specialized form of anti-tank grenade that used a hollow-charge warhead to defeat the target tank armour. To ensure that the warhead was actually facing the target armour when it struck the tank, the grenade was fitted with a finned tail for stabilization and guidance.

The Panzerwurfmine was thrown at its target in a special manner. The grenade warhead had behind it a steel body attached to a wooden handle. The user gripped this handle and held it behind his back with the warhead pointing vertically upwards. When ready the user swung his arm forward and released the handle. As soon as the grenade was in flight four canvas fins unfolded from the handle for guidance and stabilization, and the drogue effect of these fins maintained the warhead in its correct forward position

ready to have maximum effect as it struck. This sounds simple enough, but in practice the Panzerwurfmine was not an easy weapon to use effectively. For a start the maximum possible range was limited by the strength and ability of the thrower, and was usually no more than 30 m (32.8 yards) at best, and was frequently less. Accuracy could only be ensured by practice with special inert training versions.

But despite these disadvantages some of the special German anti-tank personnel greatly favoured the Panzerwurfmine. Compared with other close-in anti-tank weapons used by the Germans the Panzerwurfmine was relatively small, light and handy. It was also potent, for the warhead was made up of RDX and TNT in equal measures and weighed 0.52 kg (1.146 lb). Combined with the hollow-charge principle, this usually ensured penetration of even the thickest armour of nearly all Allied tanks. It also had the advantage of not requiring the user to approach the tank to place the grenade on the



Two examples of the German Panzerwurfmine (L) are shown as they would have been issued, with their stabilizer tails wrapped in cord around the throwing handle. These grenades were not a general issue as they required some skill to use properly, and they were mainly issued to specialist close-in tank killer squads.

Panzerwurfmine (L) (continued)

target, with all the attendant risks of such a tactic. Further safety was provided by the fact that the warhead was not fully fused until the grenade was in flight, for the act of throwing also armed the fuse.

Despite its success in German hands, the Panzerwurfmine was not copied closely by any of the Allies. Captured examples were used when they fell into Allied hands, especially by the Red Army, but the Americans often misused them for they at first thought that they were meant to be thrown in the same manner as an oversized dart; once the mistake had been discovered special intelligence bulletins were soon issued to correct this practice. After 1945 the principle was used for a while by various Warsaw Pact nations, and in recent years the Egyptians have seen fit to copy the Panzerwurfmine almost exactly as part of the output of their new indigenous armaments industry. They have discovered that this type of anti-tank weapon is exactly suited to their infantry anti-tank tactics, and their version is reported to be quite capable of killing the most modern tanks.

Specification

Panzerwurfmine (L)

Body diameter: 114.3 mm (4.5 in)

Lengths: overall 533 mm (21 in); body 228.6 mm (9 in); fins 279.4 mm (11 in)



The German Panzerwurfmine (L) was much favoured by tank killer squads, for although it was a close-range weapon it had a 114.3-mm (4.5-in) warhead that could knock out even the heaviest Allied tanks. It was thrown in such a way that the hollow charge warhead was always in front to strike the tank armour first.

Weights: overall 1.35 kg (2.98 lb); warhead 0.52 kg (1.146 lb)



GERMANY

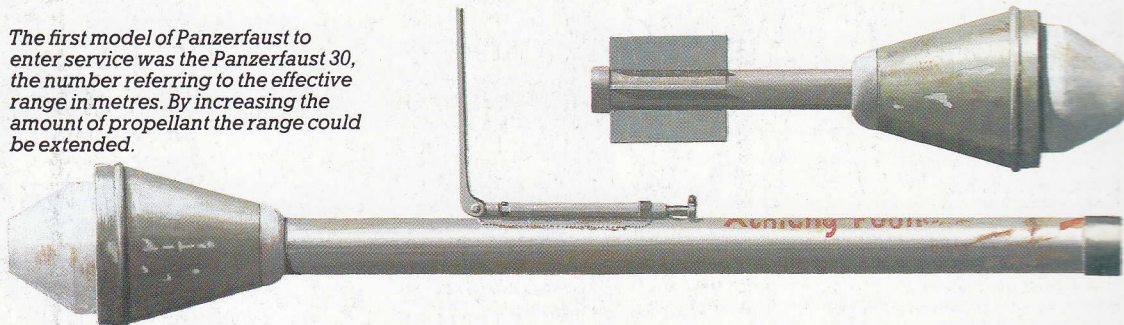
Panzerfaust

When it first appeared in late 1942, the weapon that was soon known as **Panzerfaust** (tank devil) was unique. It was developed by HASAG (Hugo Schneider AG) at Leipzig to provide soldiers with a personal anti-tank weapon, and emerged as a form of recoilless gun that also incorporated some rocket principles. The Panzerfaust was meant to be cheap and simple, and was little more than a launching tube that projected a hollow-charge grenade. Simple firing and sighting facilities were provided, and that was it. The bulk of the propellant was contained in the launching tube, and in flight four spring steel fins sprang out from the projectile body to provide inflight stabilization.

The first Panzerfausts entered large-scale service in 1943, and this initial version was later known as the **Panzerfaust 30 (klein)**, the 30 referring to the 30-m (32.8-yard) range of the device. The suffix klein (small) was appended as it was not long before a larger-diameter projectile was introduced to provide an increased anti-armour penetration capability: this was then the **Panzerfaust 30**. The short range of these early models was often a great tactical disadvantage for the firer, who thus had to get dangerously close to the target tank. But the Panzerfaust worked and proved lethal to any tank likely to be hit. Aiming was a bit difficult as it relied on using a flip-up leaf sight that had to be aligned with a pip on the projectile body, and at the same time the launcher tube had to be carefully tucked under the arm to prevent the propellant exhaust from injuring the firer.

After the Panzerfaust 30 came the **Panzerfaust 60** and **Panzerfaust 100**, both with more range provided by more propellant, although the projectile remained the same. There were

The first model of Panzerfaust to enter service was the Panzerfaust 30, the number referring to the effective range in metres. By increasing the amount of propellant the range could be extended.



plans to introduce a **Panzerfaust 150** and even a **Panzerfaust 250**, but the end of the war prevented these versions ever getting past the testing stage.

The Panzerfaust projectile could penetrate up to 200 m (7.87 in) of armour set at an angle of 30°, while the smaller Panzerfaust 30 (klein) could penetrate 140 mm (5.51 in). Therefore any Allied tank was vulnerable to the Panzerfaust, and tank crews took to adding extra protection to their vehicles, this ranging from stand-off plates along the sides to piles of sandbags around the hulls and even lengths of spare track at all likely places. The Panzerfausts were produced in their tens of thousands right up until May 1945. They could be used only once, which was something of a liability for German raw material resources, so it was planned that the projected Panzerfaust 150 and Panzerfaust 250 would be reloadable to conserve metal stocks.

The Panzerfaust exactly suited the German defensive tactics of 1943-5, and Allied tank crews came to fear the weapon. Being available in huge numbers, at least one Panzerfaust was carried by almost every German vehicle,

Right: A drill book example of how to aim and fire a Panzerfaust 30 or 60. The weapon tube had to be held under the arm or over the shoulder to allow the propellant exhaust to vent to the rear safely, so the weapon was not meant to be used in enclosed areas.

and many of the hapless Volkssturm went into action with nothing else. If the Panzerfaust was aimed properly and used at the correct range, every German soldier could have at least one Allied tank destroyed to his credit, but the introduction of stand-off armour and infantry squads accompanying Allied tanks offset some of the worst the German infantry could do.

Specification

Panzerfaust 30 (klein)

Range: 30 m (32.8 yards)

Weights: total 1.475 kg (3.25 lb); projectile 0.68 kg (1.5 lb)

Projectile diameter: 100 mm (3.94 in)

Muzzle velocity: 30 m (98 ft) per second

Armour penetration: 140 mm (5.51 in)

Panzerfaust 30

Range: 30 m (32.8 yards)



Weights: total 5.22 kg (11.5 lb); projectile 3 kg (6.6 lb)
Projectile diameter: 150 mm (5.91 in)
Muzzle velocity: 30 m (98 ft) per second
Armour penetration: 200 mm (7.87 in)

Panzerfaust 60

Range: 60 m (65.6 yards)

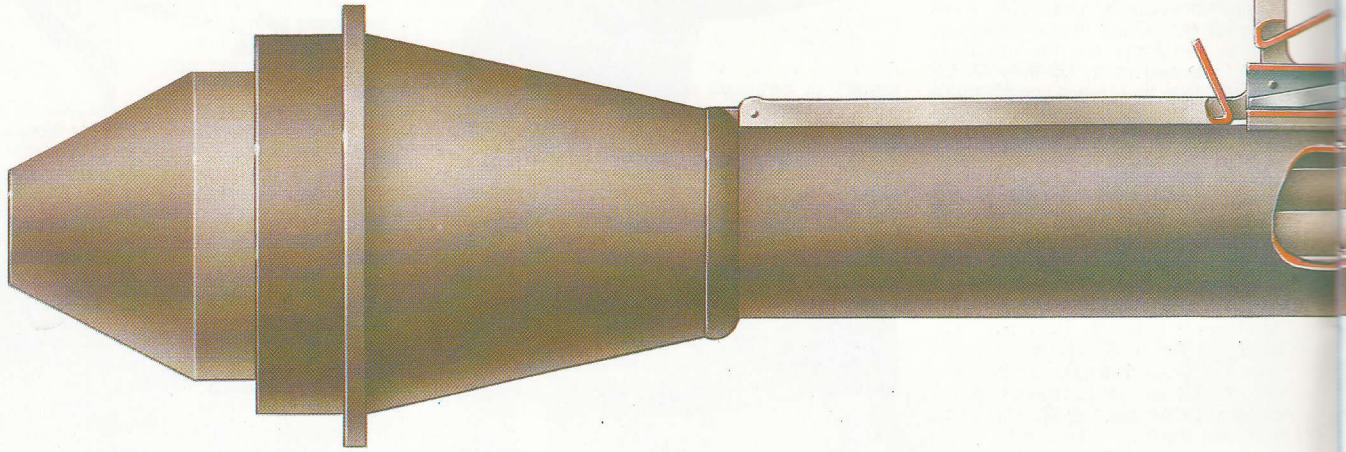
Weights: total 6.8 kg (15 lb); projectile 3 kg (6.6 lb)

Projectile diameter: 150 mm (5.91 in)
Muzzle velocity: 45 m (148 ft) per second

Armour penetration: 200 mm (7.87 in)

The Panzerfaust in Action

The excellence of Soviet tanks came as a nasty shock to the German army in 1941. German anti-tank guns could not knock out a Soviet tank at anything but point-blank range, and a race began in order to develop a complementary infantry anti-tank system. Bigger guns were quickly produced, but they were bulky weapons needing large crews and a vehicle to tow them. The German infantry needed a man-portable weapon capable of destroying a T-34.



The story of the Eastern Front in World War II is to quite a large extent the story of the Soviet T-34 tank, arguably the finest tank ever developed given the criteria of firepower, armour, mobility, reliability and simplicity of construction and maintenance. Over 40,000 T-34 tanks were built; they were still in use in the 1960s; and if the Soviets had bothered to train their crews properly in the 1940s they would have been even more effective than they were.

Work started on the T-34 in 1934; the first 115 examples were built at Stalingrad. They had a 76.2-mm (3-in) gun, a diesel-engine power-plant, sloping armour, independent suspension and wide tracks: they were excellent in mud and snow.

Vulnerable infantry

The Germans first encountered the T-34 near Grodno in June 1941, and found the type to be vastly superior to their own PzKpfw IV. The Germans also found that their infantry were extremely vulnerable to the speed and firepower of the T-34. At that time, German infantry relied on anti-tank rifles and small calibre guns (used in the attack, as opposed to British tactics which only used anti-tank guns in the defence); but they found to their horror that the only weapon effective against the T-34 was the 88-mm (3.46-in) Flak gun. In this context it is interesting to note that during late 1941 a Soviet KV-1 tank held up an entire German division for 48 hours, dug in by a bridge, until an 88-mm gun was called in to destroy it. And even then it took seven rounds, of which only two actually penetrated! Admittedly the T-34 was not quite as heavily armoured as the KV-1, but even so, in the absence of an 88-mm gun the standard defence against the T-34 entailed some brave but foolhardy soldier rushing up to the tank and dropping a fused Teller mine under the tracks, or under the turret overhang.

But before looking at the weapon the Germans developed to counter the T-34 at the level of the infantry squad and platoon, it is worth looking first at the basic problem underlying all anti-tank weaponry (and tank development itself, come to that). Essentially, every army is faced with a problem of escalation: the more powerful and better armoured the tank, the



greater the firepower needed to combat it, meaning bigger, more complex and expensive guns, which in turn lead to bigger, more complex and expensive tanks, and so on. As can be seen, ultimately only the richest nations can afford the latest in either tanks or anti-tank weaponry, and for a whole variety of reasons it is impossible to obtain parity between tanks and anti-tank weapons: one or the other will have the edge until the latest technical advance reverses the balance. Nor should the Germans be derided for using mines to destroy T-34s; the British came up with a totally asinine weapon called a 'sticky bomb'. This was a flask of nitroglycerine covered in a black stockinette impregnated with adhesive, the whole mess surrounded by a metal case. The idea was that the brave volunteer (and there were never too many) sidled up to an approaching German tank, removed the metal casing and stuck the bomb onto the side of the tank and activated the fuse, whereupon he had five seconds to get clear before the bomb exploded. The Japanese simply mounted their anti-tank bombs on the end of 9-m (30-ft) poles, the other

A drill book demonstration of the Panzerfaust 30; the later Panzerfaust 60 looked very similar. Raising the simple leaf sights armed the trigger mechanism, and the firer used the sight and a mark on the bomb to aim the weapon. Once fired, fins unfolded to stabilize the bomb.

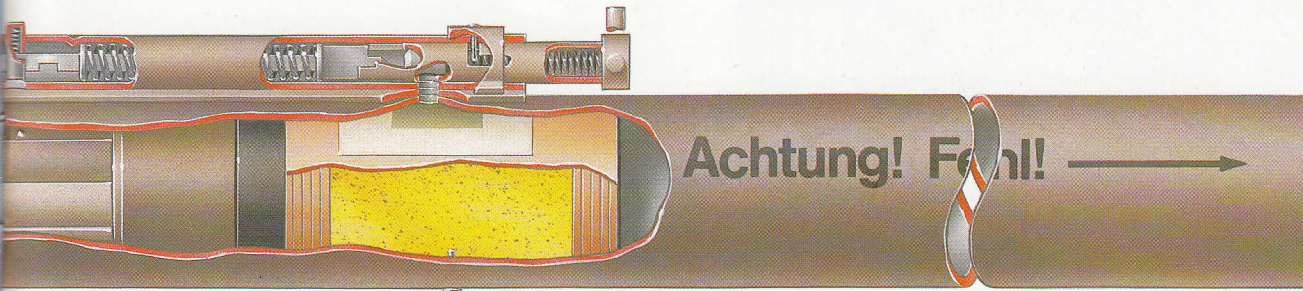
end of which was held by a soldier prepared to die for his country and emperor, which was just as well because he usually did.

The German response to the T-34 was the Panzerfaust, a small bomb fired from a disposable launcher. In its own way the Panzerfaust was as revolutionary a weapon as the T-34 and went some way to redressing the balance. And it was not used just against the T-34: after D-Day, entire Volkssturm units were armed with nothing else; and their capabilities are attested by the fact that on 29 March 1945 a small party of Volkssturm held up a squadron from the 1st Royal Tank Regiment for the best part of a day.

The Panzerfaust project was initiated by a Dr Langweiler of Hugo Schneider AG, based in Leipzig. What Langweiler required was a delivery system for a new type of bomb or projec-

Infantry Anti-Tank Weapons of World War II

A partial cutaway of a Panzerfaust 30 shows the spring-up leaf sight that primed the trigger mechanism over the tube. When released, a button trigger caused the spring to mechanically detonate the propelling charge inside the tube. This caused the bomb to be forced from the tube muzzle and a mass of gas to escape to the rear.



tile that he felt would be effective against well-armoured tanks. This bomb relied on the Monroe effect, named after its American discoverer: the high explosive warhead is produced with a cone-shaped hollow interior, copper-lined and open end facing forward, so that when the head is detonated the optimum distance away from armour plate, the explosive force goes forward, a thin focused jet of molten metal and superheated gas being directed at the armour plate at some 6000 m (19,685 ft) per second. In the case of a tank, this jet melts a hole in the armour to allow the ingress of hot gas and vaporized metal, exploding ammunition and generally making life untenable for the crew. The problem was that artillery shells were too fast and too powerful to achieve this optimum distance: they either bounced off the tank armour (on the T-34, the armour had a 30° slope) or exploded too close to the tank armour, and although the difference could be measured in millimetres, this was enough to make the hollow-charge warhead ineffective. Anyway, the idea was to provide front-line troops with anti-tank capability. Dr Langweiler's solution was the disposable rocket-launcher. The tube was eventually manufactured by Volkswagen Werker at Fallersleben, and by 1943 over 200,000 per month were coming off the production lines.

First Panzerfaust

The original weapon was called the Faustpatrone, and was designed to be fired at arm's length and at right angles to the body. After it was pointed out to Langweiler that this made aiming slightly difficult unless the operator was so close to the T-34 that he might just as well use a Teller mine, the first Panzerfaust (Gretchen) was developed.

Its official classification was the Panzerfaust 30 (klein). It was a 76.2-cm (30-in) tube firing a 1.5-kg (3.3-lb) bomb at 30 m (98 ft) per second and possessing a maximum effective range of 30 m (98 ft); the bomb's diameter was 100 mm (3.94 in), and the explosive charge would penetrate 140 mm (5.5 in) of armour sloped at 30°. Propulsion was by a charge in the tube base, though later versions added a rocket charge to the projectile itself. The Panzerfaust



30 (klein) was soon superseded by the Panzerfaust 30, 60 and 100 (the numbers indicating the range in metres) which fired a bomb weighing 3 kg (6.6 lb) at 30, 45 and 62 m (98, 148 and 203 ft) per second respectively. Each one could penetrate up to 200 mm (7.87 in) of armour, again at a 30° slope. An explosive called cyclonite was used as the initiating charge; this was highly unstable, and had to be mixed with beeswax to prevent the molecules rubbing together and exploding when the Panzerfaust was fired. Most German soldiers were almost as terrified of this new weapon as they were of the tank it was designed to defeat; even so, it was infinitely preferable to hurling mines, particularly as T-34s often went into action with Soviet infantry riding on them (the T-34 boasted specially designed handrails) who were unlikely to sit idly by while a German ran up to destroy their ride. Even so, this use of infantry in close (very close) support of tanks made the Panzerfaust almost as dangerous for the user as for its tank target: if the Panzerfaust was fired at 100-m (110-yard) range, and if they saw the discharge, the infantry had time to jump off and

The more complex leaf sight indicates that this is a Panzerfaust 60. The fired bomb weighed 3 kg (6.6 lb) and the warhead could penetrate 200 mm (7.87 in) of armour. The later Panzerfaust 100 was essentially similar, but it had a longer range firing the same bomb.

fire back. Even if they did not, the Panzerfaust did its damage inside the tank by sending molten metal and hot gas swirling amongst the crew and so did not always 'take out' exterior passengers, who could then retaliate. Nonetheless, from the very first the Panzerfaust was successful and allowed German infantry to furnish close support to their own tanks.

But what of the Soviets, and how did they cope with this new threat? Their first response was to attach to their tanks extra armour designed to combat the Panzerfaust effect. This armour could be (and often was) as basic as sandbags sited over the most exposed parts of the tank, or hanging steel plates that would help dissipate the hollow-charge effect. At the same time, tactics changed so that tanks always advanced with infantry support, and this support was often in advance of the tanks them-

The Panzerfaust in Action



selves. Infantry casualties might thus be even higher than normal, but at least the more expensive tanks had a greater chance of surviving. If the Americans' response is to throw money at a problem, that of the Soviets is to throw men.

Firing the Panzerfaust

What was it like to fire a Panzerfaust? First, you are probably very frightened because the enemy tanks are extremely close to you. You are sheltering behind a tree or a large bush if you have been able to find one, or dug into a large hole somewhere, or if you are fighting in a city or town (where the Panzerfaust is at its most effective) behind a wall, all because loading the Panzerfaust takes time and leaves you very vulnerable: you would rather do it out of sight of the advancing Soviets. You take the 50-mm (1.97-in) diameter tube and slide the bomb into it tail first, the warhead overlapping the end of the tube. As the bomb tail reaches the end of

the tube, two little catches lock into place to hold it there. So far so good. The trigger mechanism is on top of the tube, covered by a protective steel housing. You can flip the housing up and it turns into a back sight, and this is where the hard part starts, because at the same time the two retaining catches at the tube base are released, and the bomb has a tendency to slide out of the end of the tube if it is pointing towards the ground. And you do not care if your sergeant has promised you that it will not explode, for it just might, and anyway it is both embarrassing and time-wasting, and that T-34 is advancing towards you at well over 30 km/h (20 mph).

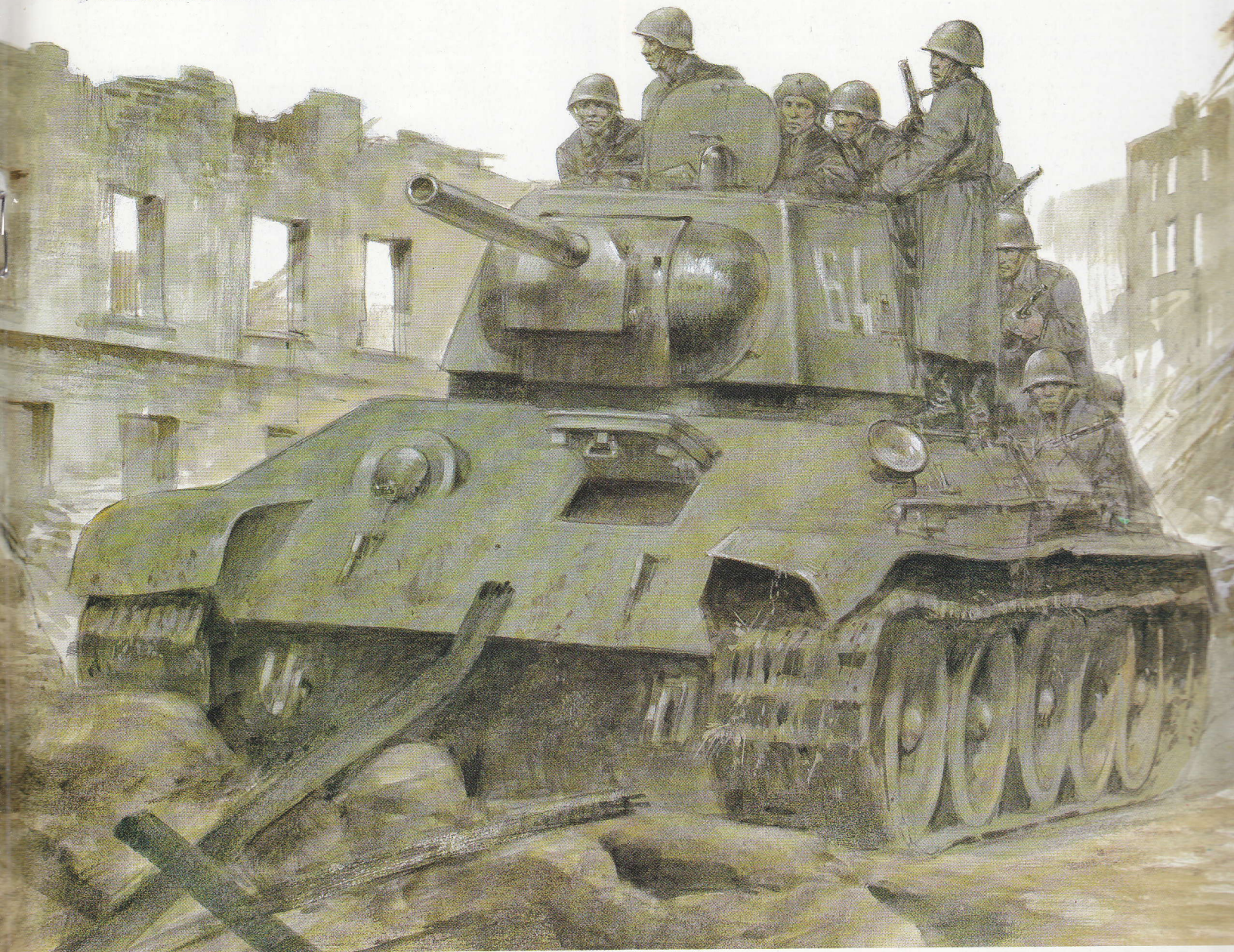
Now you have to fire it. The accepted and taught position is to stand up with the tube under your right arm, pointing beyond and away from your body to shield you from the back blast (hopefully your number two has also remembered to get out of the way); your left hand is clamped behind the 'muzzle', your right

hand operates the trigger mechanism, and your head is bent over at an angle to sight the weapon.

However, like most infantrymen you will have discovered the best way of firing the Panzerfaust is the way that does not appear in the manuals. What you have done initially is to choose a position that allows the tank to come to you (no leaping out from behind a tree waving a bulky steel tube for you). You are sitting down, legs folded underneath you and spread; your left arm and elbow are supported on your left knee and your body is bent more naturally forward; this way you can both get a better sighting and present a smaller target.

The tank is within range; you press the trigger, which ignites the propellant charge and the bomb roars out of the holder. You can watch it in flight, notice that half way towards its target the secondary propelling charge attached to the bomb ignites, and see with a high degree of satisfaction that the bomb hits its

A Soviet T-34/76 laden with Soviet infantrymen rumbles through the heart of a town in East Prussia. The infantry scan the shattered buildings for any sign of resistance, their PPSH sub-machine guns at the ready; the tank itself has a 76-mm shell in the breech and its two machine-guns loaded. Unobserved by the Russians, a solitary German waits behind a wall, his Panzerfaust cocked and ready to fire. It is only accurate at point-blank range, but its warhead can burn right through the tank's armour to destroy both vehicle and personnel. As soon as the T-34 draws level, he will lean around the corner and fire.



target and explodes in the approved manner. The tank lumbers on for a few yards before slewing to one side and coming to a grinding halt. A wisp of smoke trickles out of the turret, followed by flames and then a thunderous explosion as the tank's ammunition goes up. But you are not watching this: you are too busy getting as far away as possible from the accompanying infantry and other tanks, which even now are pouring fire in your direction. Not for the first time you are thankful that Soviet tank crews are so badly trained. And not for the first time do you thank your stars for the Panzerfaust: it may not be ideal, but it is all you have got. More to the point, it works.

By mid-1944 the Panzerfaust was widely issued to all front-line combat troops. This unfortunate German soldier was killed at Sept Vents in Normandy on 30 July 1944 before he could use his Panzerfaust 30(klein). With it the soldier would have been able to knock out any Allied tank.





GERMANY

Anti-tank rifles

The German army used two main types of anti-tank rifle but, as will be related, they attempted to develop many more models. The first in-service weapon was the 7.92-mm **Panzerbüchse 38**, an 0.312-in rifle produced by Rheinmetall-Borsig. This was a weapon that was both complex and expensive, for it resembled a miniature artillery piece so far as the breech mechanism was concerned. This featured a small sliding breech block and an automatic ejector for the spent cartridge case. About 1,600 of these anti-tank rifles were procured by the German army, but the type was not accepted as a full service-standard weapon although those that were produced were retained in service and were used during the early war years.

The standard German anti-tank rifle was the 7.92-mm **Panzerbüchse 39**. This was a much simpler weapon than the **Panzerbüchse 38** and was produced by the Gustloff-Werke of Suhl. This weapon still had a sliding breech block for the powerful cartridge, but the block was operated by pulling down the pistol grip. Like the earlier rifle it was a single-shot weapon and the stock could be folded to make carriage more handy. Extra ammunition could be carried on the weapon in small boxes secured on each side of the breech mechanism.

These two anti-tank rifles fired the same ammunition, which originally used a hard steel core. In 1939 numbers of Polish *Maroszek* anti-tank rifles were captured, and on examination it was found that the bullets fired by this very effective weapon had a tungsten core that gave much better armour penetration. The Germans seized upon this principle and adopted it to lengthen the service life of their own anti-tank rifles, which would otherwise have been rendered obsolete by increases in enemy tank armour.

The Germans developed a surprising number of follow-on designs in an effort to replace the **Panzerbüchse 39**. Various manufacturers produced a series of prototypes, all of them in 7.92-mm calibre, but none of them got past the prototype stage. There was even a programme to develop an anti-tank machine-gun known as the **MG 141**, but again that did not proceed far

The Panzerbüchse 39 is shown in the travelling position (below) and with the bipod lowered and stock extended ready for action (above). German anti-tank rifles were rendered obsolete by the increasing thickness of tank armour.



*An Afrika Korps soldier is seen with a 7.92-mm (0.312-in) **Panzerbüchse 39**. This was a single-shot rifle that fired tungsten-cored projectiles. The projectile could penetrate 25 mm (0.5-in) of armour at 300 m (328 yards), making it unable to tackle any but the lightest tanks after 1940.*

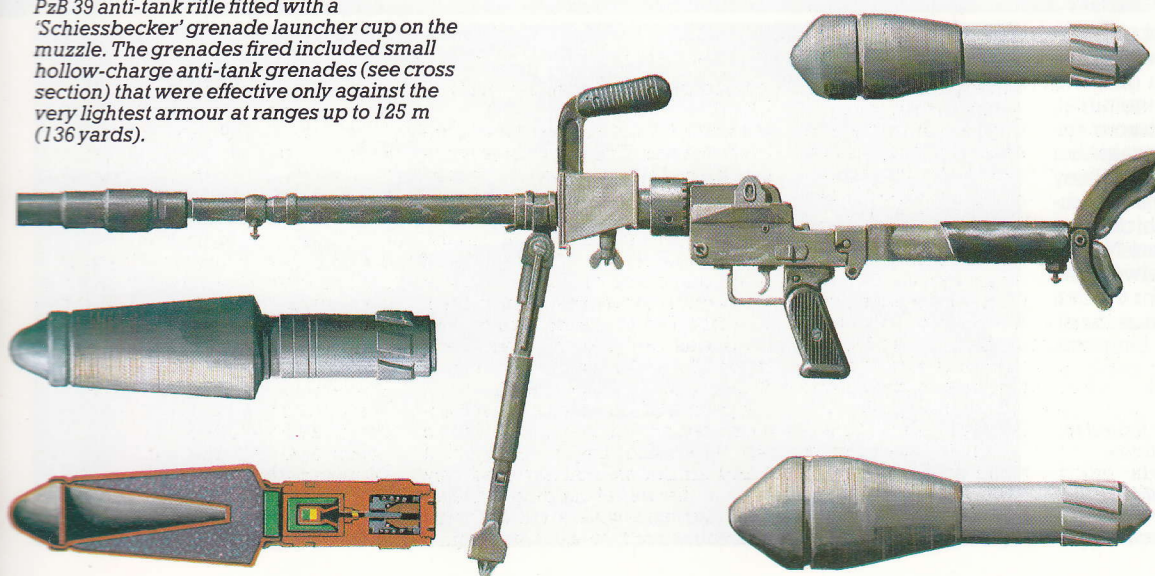
along its development path.

There was one further anti-tank rifle used by the Germans, but this was a Swiss product known as the 7.92-mm **M SS 41**. This was produced by Waffenfabrik Solothurn in Switzerland to German specifications, but not many

appear to have been made or delivered though some were used in North Africa. Solothurn was also responsible for the design and manufacture of a weapon more accurately described as an anti-tank cannon, for it was the 2-cm **Panzerabwehrbüchse 785(s)**. This was

a fairly bulky weapon that was towed on its own two-wheeled mounting, and again only a limited number were procured by the Germans. Others went to Italy, where the type was known as the **Fucile anticarro**. It was an automatic weapon that used five- or 10-round magazines, and was sometimes known as the **s18-1100**; some were used by the Netherlands during 1939 and 1940 as the **Geweer tp 18-1110**.

*The German **Granatbüchse 39** was a converted PzB 39 anti-tank rifle fitted with a 'Schissbecker' grenade launcher cup on the muzzle. The grenades fired included small hollow-charge anti-tank grenades (see cross section) that were effective only against the very lightest armour at ranges up to 125 m (136 yards).*



Specification

PzB 38

Calibre: 7.92 mm (0.312 in)
Lengths: overall with stock extended 1.615 m (63.58 in); barrel 1.085 m (42.72 in)
Weight: 16.2 kg (35.71 lb)
Muzzle velocity: 1210 m (3,970 ft) per second
Armour penetration: 25 mm (0.98 in) at 300 m (328 yards)

PzB 39

Calibre: 7.92 mm (0.312 in)
Lengths: overall with stock extended 1.62 m (63.78 in); barrel 1.085 m (42.72 in)
Weight: 12.6 kg (27.78 lb)
Muzzle velocity: 1265 m (4,150 ft) per second
Armour penetration: 25 mm (0.98 in) at 300 m (328 yards)

How Hollow Charges Work

As tanks became more heavily protected, so much power was needed to punch a hole in their armour with conventional shell that anti-tank rifles were rendered obsolete and anti-tank guns steadily grew in size. Exploiting the properties of explosive known as the Monroe effect offered an alternative means of attack, with the added advantage that penetration did not deteriorate as range increased.

The phenomenon known as the hollow-charge effect was first noticed during the 1880s by a number of experimenters, but especially by an American engineer named Monroe who for a while gave his name to the effect. It was noted that if a slab of explosive was recessed with, say, the maker's name, the area of a metal plate under that recess was burnt into whereas the rest of the plate was simply buckled or dented. This Monroe effect was at first treated as an explosive curiosity, and it was not until the 1920s that ballistic designers started to examine the Monroe effect to see if there was any scope in it for use against tank armour. A German named Neumann discovered that if the explosive recess was lined with a thin layer of metal the burning effect was much enhanced, and the way was open for the Monroe effect to become the hollow charge.

By a series of experiments carried out in a number of countries during the 1920s and 1930s, the hollow charge was developed into a viable anti-armour weapon. The initial recesses in a slab of explosive grew into a definite shaped or hollow charge which was circular and with a deep impressed cone set into one face of the explosive charge. This charge was intended to be set off at a fixed distance from the armour to be penetrated, and one of the early experimental results was to show exactly how far away this distance had to be for a given charge. The idea was that the explosion, usually set off by a rear-mounted fuse, would concentrate in the cone and move forward at very high speed towards the target armour. This concentration formed an intense jet of very high temperature particles that could burn its way through a considerable thickness of armour. By lining the interior of the explosive cone with a thin layer of metal this burning effect could be considerably enhanced. Several types of metal were used at one time or another, copper being one of the most effective. Other metals used included zinc, aluminium and thin steel.

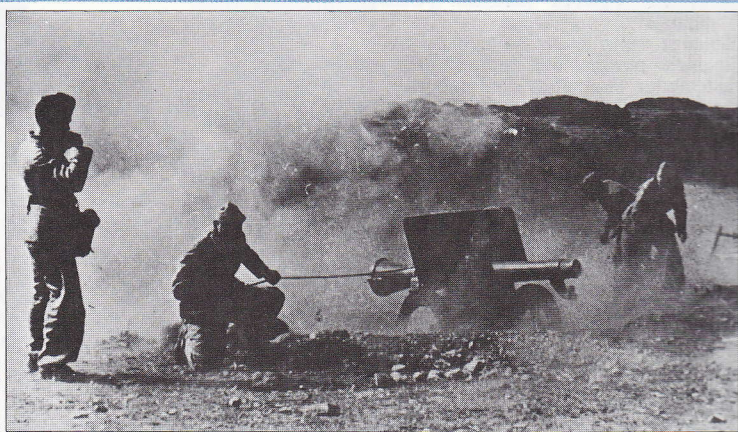
Reliable performance

This hollow-charge effect was seen to be a considerable step forward in the battle against armour, and it had the advantage that it did not rely upon weapon delivery range to vary its performance: it would work as well at 1000 m (1,094 yards) as it did at 10 m (11 yards) away from a weapon muzzle. The first weapons to use the hollow-charge effect were guns of the conventional kind, but it was soon discovered that the hollow charge did not perform as predicted when used in artillery projectiles: these rely upon imparted spin for stabilization and this spin tended to disperse the intense explosive jet instead of allowing it to concentrate. The answer was to use non-rotating projectiles to carry the hollow-charge warheads, and this usually meant rockets or something similar which by their very nature had to be relatively short-range projectiles. Thus in rapid order nearly every combatant nation developed a new form of short-range anti-tank weapon, typical of which were the American bazooka, the British PIAT and the German Panzerfaust. These were all short-range warhead-delivery systems that fired non-spinning projectiles, and they were all very effective.

The hollow charge was not the ideal anti-armour weapon it at first promised to be, for it could be easily countered by the use of stand-off armour. This consisted of sheets of thin metal or even wire mesh suspended from the sides of tanks:



British soldiers demonstrate an array of captured German anti-tank weapons. The soldier on the left is leaning on an 8.8-cm (3.46-in) RP 43. The sergeant is holding a Panzerfaust 30 (klein) in his right hand and a Panzerfaust 30 in his left. All these weapons carried hollow charge warheads.



A German 10.5 cm (4.14-in) LG 40 is fired on the ranges and clearly shows one of the main disadvantages of the recoilless gun, namely the large cloud of dust and debris kicked up by the mass of gas escaping through the rear venturi. This gun could fire hollow charge projectiles and could knock out most tanks.

when the hollow-charge projectile struck such a stand-off screen it reacted as though it had hit the real armour. The resultant jet was thus dissipated in the open area behind the screen with little if any damage to the main tank. Other things that could be used as stand-off protection were sandbags, spare track links and even curtains of chain. Recent developments include the use of 'active armour' which explodes as the fire jet reaches it literally to snuff out the fire jet.

The hollow charge is still used as it remains an effective anti-armour weapon that is relatively easy to produce and employ, despite the number of measures which can be taken to counter its effects.

JAPAN



Lunge mines

By 1944 the plight of the Japanese units that made up the garrisons on the occupied islands in the Pacific approaches to the Japanese home islands was more than desperate. The overwhelming Allied superiority in air and sea power meant that many garrisons could not expect to receive anything other than the very smallest increments in supplies or new equipment, but at the same time they were being ordered to prepare themselves for invasion and to be ready to defend themselves against tanks and other armoured vehicles. The only possible course of action was to introduce locally-produced anti-tank weapons, and among these was a weapon known as the lunge mine that could be easily produced using local materials and readily-available explosive charges.

The lunge mine is an old weapon,

and consists of an explosive charge at the end of a long pole to enable it to be placed against a gate or other obstacle to blow it out of the way. The Japanese adopted this device for use against tanks by converting the explosive into a rudimentary hollow charge by reshaping the explosive into a simple cone with an internal depression; the correct stand-off distance was ensured by using three steel nails around the periphery of the warhead. The pole was a length of bamboo, as long as could be cut or as the user could handle. To fire the mine a safety pin was first removed and the user then pushed the mine against the target tank. This operation caused a striker to push against the detonator and so fire the main charge. There was no delay, so using the mine was at best hazardous and at worst suicidal, but that seemed to suit

the Japanese defensive mentality of 1944-5.

Some of these improvised lunge mines used the **Type 3 Grenade** as the warhead. Under ordinary circumstances this was an anti-tank grenade along the same general lines as the German Panzerwurfmine, but the canvas fins were replaced by a loose tail of hemp strands. As the hurled delivery of this grenade was rather inaccurate, use of the Type 3 as a lunge mine warhead was deemed more efficient, especially as it could penetrate up to 70 mm (2.75 in) of tank armour.

Japanese lunge mines were not encountered all that often on the Pacific islands for the simple reason that Allied armour was usually used only during the initial landing phases. When the mines were employed it was noticeable that their users were quite

prepared to ignore the presence of tank-protecting infantry in their eagerness to obey orders and 'kill' an Allied tank, so many were shot down before they even got near their intended prey. Those that did often perished in the resultant explosion, and few appear to have given their own personal safety any thought as they rushed towards their targets and the chance to somehow delay the inevitable final defeat.

Specification (provisional) Lunge mine

Weights: body 5.3 kg (11.68 lb);
charge 2.9 kg (6.4 lb)
Length: body 279 mm (11 in)
Diameter: at base 203 mm (8 in)

Suicide anti-tank methods

The users of Japanese lunge mines were often killed at the moment of explosion, but the lunge mine was not really a 'suicide weapon', for in theory the user had a good chance of surviving. The Japanese suicide anti-tank weapons were rather more extreme, for by 1944 it had become an accepted method of warfare that Japanese soldiers, sailors and airmen were called upon to commit suicide as a measure to destroy Allied equipment and personnel in an attempt to keep the Allies away from the Japanese home islands, together with their spiritual and material resources. The best known of these suicide measures was the *kamikaze* flying bomb, but there were others that are now less well known, including various forms of self-destruction involved in eliminating Allied tanks.

Perhaps the most extreme of these were the backpack human mines. This weapon was very simple to devise and devastating in use, for it consisted of little more than a canvas backpack loaded with about 9 kg (19.8 lb) of explosive to form a satchel charge. The user wore this charge and concealed himself until an Allied tank approached. He then ran forward to the tank and dived underneath it, at the same time pulling a length of cord that initiated a short delay to ensure the tank would be right over the charge before it exploded, destroying both tank and user. This tactic was hard to counter, for very often the user waited until the tank was really close before making his suicide rush, so protecting infantry had to be very quick to react if they were to prevent the attack. It was also very unnerving for Allied tank

crews. A variant on the satchel charge was a Type 93 anti-tank mine on a pole which was simply shoved under a track with dire results for both the track and the user.

A further modification on the suicide theme was encountered in some parts of Burma in 1945. Here there was no deliberate death rush, for the hapless anti-tank troops were concealed in foxholes either in the centre of roads or tracks, or at the sides of routes that Allied tanks were expected to use. There they remained until a tank approached, and once one was overhead or very close the idea was that it would be destroyed by the man in the foxhole setting off a charge: this might be a simple explosive device, or a form of mine, or sometimes even a small aircraft bomb. The charges were set off manually and deliberately by

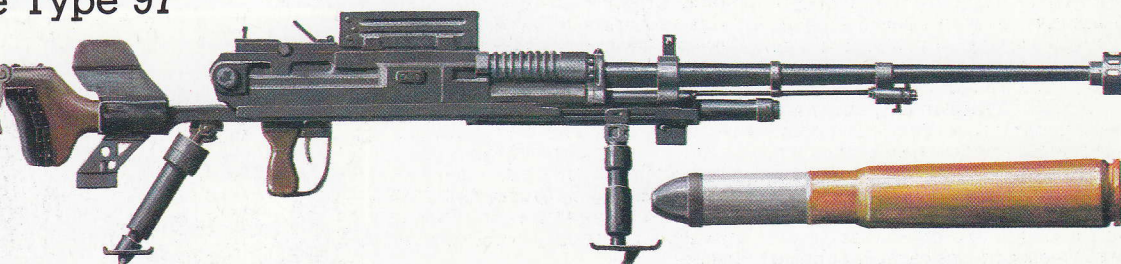
the suicide candidate, who acted as little more than a human fuse. In practice this ploy did not work too well for the personnel in their foxholes were easily spotted by infantry and were killed before they could use their charges. Accounts exist of Allied personnel surrounding foxholes and their suicidal occupants without the Japanese making any attempts to injure the attackers with their charges: the philosophy appears to have been that such attackers were not tanks and the explosives had to be saved to use against tanks, not infantry. As these suicide anti-tank miners had no weapons other than their explosives they were killed in their foxholes to no benefit for the Japanese war effort.

Anti-tank Rifle Type 97

When it came to anti-tank rifles, the Japanese general staff decided to go one better than most contemporary designs and produce a rifle firing a powerful 20-mm (0.79-in) cartridge. This emerged as the **Anti-tank Rifle Type 97**, and while it was certainly a powerful weapon by the standards of the day it was also extremely heavy, weighing no less than 67.5 kg (148.8 lb) when being carried and 51.75 kg (114 lb) once emplaced. Much of this weight resulted from the adoption of a gas-operated mechanism which was locked by a tilting breech block. Ammunition was fed from an overhead seven-round box magazine.

Once emplaced the Type 97 used a bipod mounted just forward of the body and a monopod under the butt. Despite the ferocious recoil the weapon was intended to be directed and fired from the shoulder, which cannot have endeared the weapon to its users. Normally the Type 97 was carried on two special poles by two men, but more often four men were used. It was possible to fit a small shield for added protection and to this shield could be added a carrying bar that resembled bicycle handlebars, though this component was often omitted to reduce the weight of the weapon. Another one of these carrying bars could be added under the butt. In action the Type 97 was often difficult to spot as it was a long, low weapon.

During the early months of the Pacific campaign the Type 97 proved itself to be a useful weapon against the light tanks it was called upon to tackle but once larger and heavier tanks (such as the American M4 Sherman) appeared on the scene the Type 97 was no longer of much value. At best it could penetrate 30 mm (1.18 in) of case-hardened armour at 250 m (273



The Japanese Type 97 anti-tank rifle was a heavy weapon that weighed 51.75 kg in action, mainly due to the gas-operated semi-automatic mechanism. It had a calibre of 20 mm (0.787 in) and required a crew of two men to fire and four to carry it, using a system of frames.

yards), and against anything heavier it was of little use. But the Japanese did not phase out the Type 97 as they were far too short of modern weapons to let any be discarded. The Type 97 was retained, but no longer primarily for anti-armour use: instead many of those available were emplaced as anti-invasion weapons on the Pacific islands, where they were sometimes able to cause damage to landing craft and light amphibious landing vehicles. Some measure of anti-armour capability was retained by the fitting of special grenade launcher cups to some Type 97s. These launcher cups could be secured to the muzzle by means of a locking bar once the circular muzzle brake had been unscrewed. The idea was a copy of the German Schiessbecker grenade-launchers, and used very similar grenades. But the principle, although of some effectiveness, was more suited to orthodox service rifles than to the large and complex Type 97 so it was not used extensively.

Overall, the Type 97 was not used by the Japanese in any great numbers. The complexity of the weapon made it rather difficult and thus costly to produce, and after 1942 the operational



The 20-mm (0.787-in) Type 97 anti-tank rifle used a gas-operated mechanism, but the heavy recoil involved meant that a fully-automatic mode could be little used. Four men were needed to carry this rifle using special frames, and a shield was an optional extra. The box magazine held seven rounds.

requirement for it was limited.

The ammunition fired by the Type 97 was produced in several forms. Apart from the usual armour piercing round (with tracer) there was a high explosive projectile (with tracer and with an optional self-destruct), a high explosive incendiary and a practice

round. The armour-piercing projectile had a solid steel body, and there was also an incendiary projectile complete with a tracer element.

Specification

Anti-tank Rifle Type 97

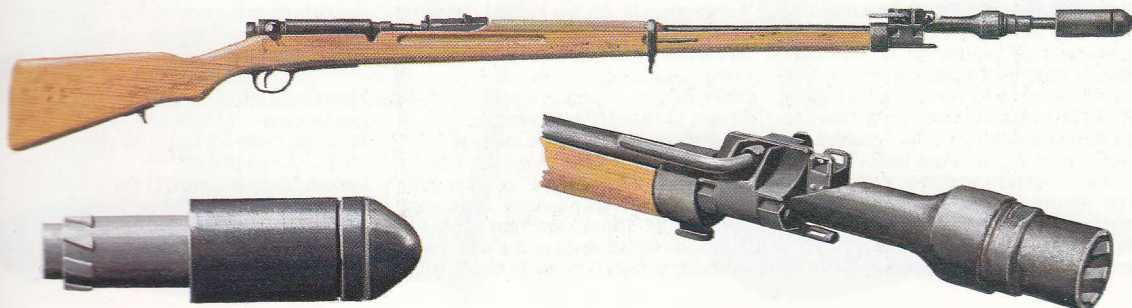
Calibre: 20 mm (0.79 in)

Lengths: overall 2.095 m (6 ft 10.5 in); barrel 1.063 m (3 ft 5.9 in)

Weights: travelling 67.5 kg (148.8 lb); in action 51.75 kg (114.1 lb)

Muzzle velocity: 793 m (2,602 ft) per second

*The Japanese Type 2 anti-tank grenade launchers could be fitted to the muzzle of all Japanese service rifles. They were direct copies of the German *Gewehr Panzergranate* and the grenades had calibres of 30 or 40 mm (1.18 or 1.57 in).*





UK

PIAT

PIAT stood for **Projector, Infantry, Anti-Tank Mk 1**, and denoted a British anti-tank weapon that somehow bypassed the usual stringent weapon-selection procedures used by the War Office as it was a product of the unusual department known colloquially as 'Winston Churchill's Toy Shop'. It was designed to make use of the hollow-charge anti-armour effect and fired a useful grenade that could penetrate almost any contemporary tank's protection, and thus it came into the same general category as the American bazooka or the German Panzerfaust. However, the PIAT relied not upon chemical energy to deliver its grenade but coiled spring energy, for the weapon worked on the spigot mortar principle. Using this method the PIAT grenade was projected from an open trough and was supported for the initial part of its travel by a central spigot. Pulling the trigger released a powerful main spring and this spring enabled the spigot to strike the grenade's propelling charge to fire it from the trough. The propelling charge also recocked the main spring ready for another grenade to be loaded.

The PIAT was intended primarily as an anti-tank weapon, but it could also fire high explosive and smoke grenades, which made it much more versatile than many of its contemporaries. It was a very useful weapon in house-to-house and urban combat, for the forward monopod was capable of being extended to provide a fair degree of elevation for use in confined spaces.

The PIAT replaced the Boys anti-tank rifle as the infantry's standard anti-tank weapon, and it was issued widely throughout the British and some Commonwealth armies. However, it cannot be said to have been very popular for it was rather bulky and heavy and required a two-man team to handle it. The main point of unpopularity was the powerful mainspring. This generally required the efforts of two men to cock it. If a grenade failed to fire the weapon was all but useless, for recocking the PIAT when the enemy was nearby was a very risky business. But if it fired all was well and the grenade could knock out virtually any enemy tank. In fact the use of the PIAT spread outside the ranks of the infantry, for it was often the

While others went for rocket-propelled hollow charge anti-tank bombs, the British used the Projector Infantry Anti-tank – the PIAT. It was a form of spigot mortar that used a powerful central spring to fire its projectile from a front-mounted 'trough'. It was not a popular weapon, but it could kill tanks.

main armament of light armoured vehicles such as the various Universal Carriers and some light armoured cars. There was also some limited use of the weapon on various carriers, which mounted up to 14 PIATs on a multiple mounting for use as a mobile mortar battery.

The PIAT served on for some years with the British army after World War II, but was replaced as soon as possible. Although it was an effective tank-killer it used a principle that was not adopted by any other designers. It did have the advantage that it could be produced in quantity and at a relatively low cost at a time when anti-tank weapons of any type were in great demand.

Specification**PIAT**

Length: overall 0.99 m (3 ft 0 in)

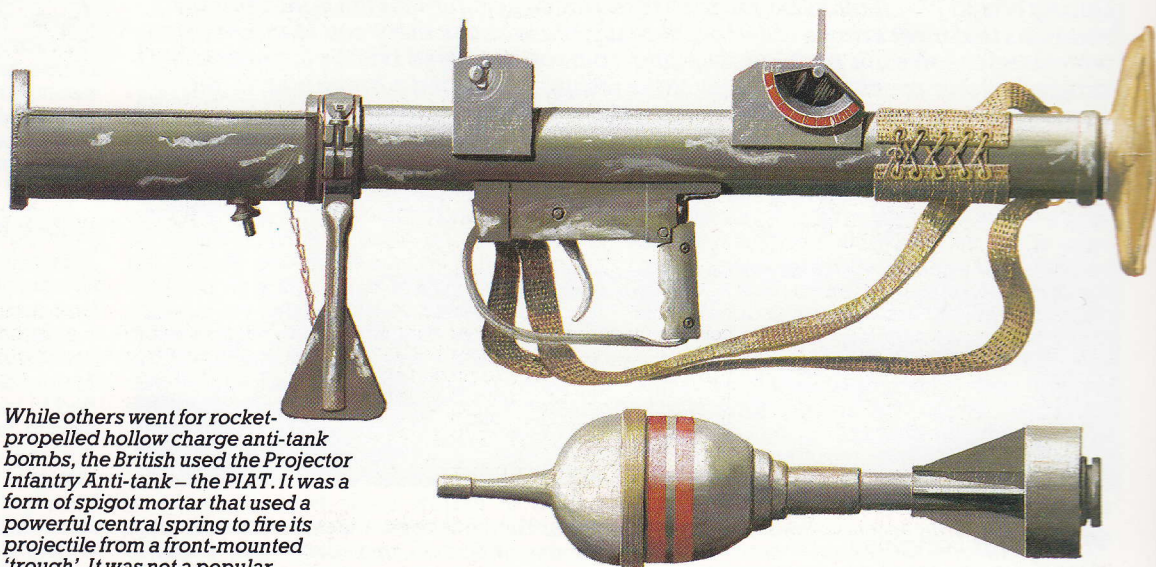
Weights: launcher 14.51 kg (32 lb);

grenade 1.36 kg (3 lb)

Muzzle velocity: 76–137 m (250–450 ft) per second

Ranges: combat 101 m (110 yards); maximum 338 m (370 yards)

Infantry Anti-Tank Weapons of World War II



Above: The PIAT was the British Army's standard squad anti-tank weapon after 1941 and was carried and used by most combat arms and services. It was a rather hefty load to carry, but it could knock out most enemy tanks at close ranges and could fire HE and smoke bombs as well.

Below: Here the crew of a knocked-out British tank are covering their position armed with a PIAT until a recovery vehicle can arrive to retrieve the damaged vehicle. The men are from the 13/18th Hussars, and the location is near Mount Pincon, northern France, July 1944. Note the No. 4 rifle near the PIAT.



Tank Killers

During World War II tanks began to carry so much armour that the light anti-tank weapons that most armies relied on were unable to knock them out. Many methods were used to solve this problem, ranging from sophisticated bombs to the brutally simple Molotov cocktail, yet whatever the weapon it needed a brave man to get close enough to use it.

During World War II the main weapon for use against the tank was the anti-tank gun as far as most soldiers were concerned, but there were many occasions when anti-tank guns were not available and recourse had to be made to other methods of tackling tanks. Some of the weapons involved are covered in detail in this study, but just as important as these weapons were the methods that soldiers (usually the infantry) used to counter tanks at close range. All through World War II every army used to some extent the concept of the tank-killing squad, but whatever their nationality the methods employed were in general remarkably similar.

World War I origins

The first tank-killer squads had their origins during the late stages of World War I, but these were usually ad hoc units formed to meet an immediate need and few formal drills were established. This remained unchanged until the Spanish Civil War (1936-9), when Republican infantry gradually evolved methods of attacking Nationalist tanks using all manner of improvised weapons such as the first Molotov cocktails. The natural heir to these Spaniards was the British Home Guard, which was almost entirely without weapons when it was raised in the post-Dunkirk days of 1940. The Home Guard had to provide some type of anti-tank defence for itself, and before very long had formed its own tank-killer squads.

Many of the instructors who formed these first Home Guard squads had gained some battle experience in Spain, and they had also analysed the tactics used during the previous winter (1939-40) by the Finns in their defence against the Soviets. They had laid down the tactics that were to be used almost without change throughout the rest of World War II and since, and these tactics were formulated at a time when weapons of almost any sort were in dire shortage.

Restricted crew vision

The tactics were evolved on the basis of several simple and elementary facts. One was that when a tank is closed down in action its crew is blind to virtually everything around the tank and fields of view are restricted to a very few areas, usually to the front. Another was that tanks cannot travel over literally every type of terrain. There are times when they have to channel their forward progress through definite points, where they tend to bunch together and can be relatively easily approached without danger. These two basics were at the heart of much of the tank-killer squads tactics.

It took a little time for untrained soldiers to learn that tanks could be approached without excessive danger, but once that point had been grasped the rest followed naturally. Of course enemy tanks could not be simply

approached across open terrain, but it took only a little cover and care to get quite close to the almost-blind tanks of the day. The thing was to arrange to be close at hand as the tanks approached. This was where the second fact came into play, for it took only a little preparation and ingenuity to ensure that the enemy's tanks would be channelled in their progress to a suitable 'killing ground'. This could be done by blowing up bridges or by effecting other suitable demolitions to channel the tanks to the area where the defenders wanted them to be. Many examples of this could be quoted, ranging from the approaches to villages to rural defiles or narrow roads between banks or walls. The banks or walls could provide cover for the defenders until they were ready to pounce.

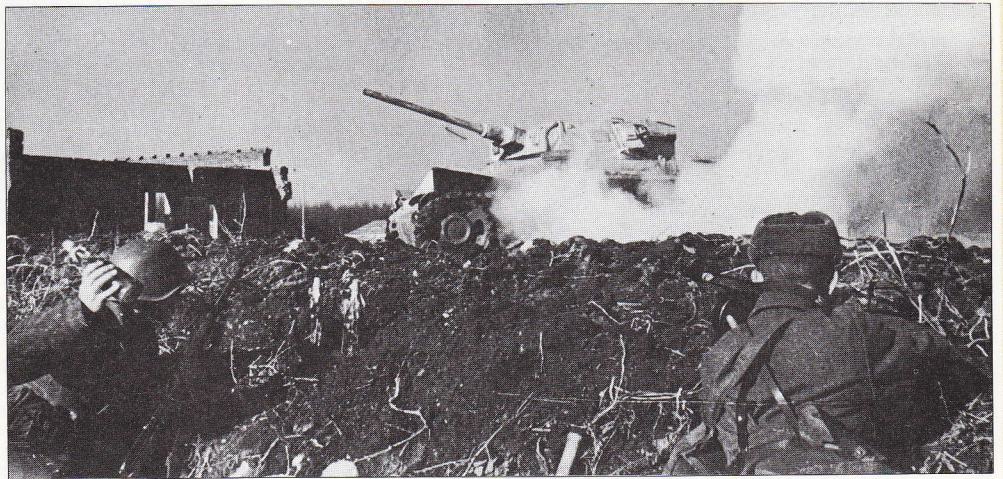
The infantry tank-killer squad was usually made up of four or so men, all of whom were trained for their role. Indeed, in some armies the soldiers involved carried out no other combat tasks. In the British army and some others all soldiers were at least partially trained in these tactics and were expected to carry them out on demand. In the German army and Soviet

armed forces the tank-killers tended to be specialists. The British Home Guard were the British exception, but they never had a chance to demonstrate their proficiency, for the German invasion never came. If it had the German tank arm would have had a hard time of it, for the British countryside and many British towns and villages would have been virtual death-traps for them.

British Home Guard

The generally enclosed nature of the British countryside was ideal for tank-killing. Defiles, both natural and man-made, proliferated and it was among them that the Home Guard squads practised their concealment and stalking skills. Having few proper weapons the Home Guard had to make use of improvised devices, chief among which would have been the Molotov cocktail or some other form of petrol-based weapon. Channelling the enemy tanks to a suitable spot was often easy enough for the defenders, and careful concealment could be used during this 'approach' phase. Once the tank was really close the squad moved into action: it rarely moved from the front but instead

A Red Army tank killer squad in action against a German PzKpfw 111. The soldier on the left is about to throw a Molotov cocktail petrol bomb to join one already thrown. This picture shows clearly how close these tank killer squads had to get to their quarry and how they had to operate from close cover.



A US Army bazooka team in action in Normandy during the summer of 1944. While the gunner takes aim, the loader faces away to avoid the dust and debris that would be kicked up by the backblast of the fired rocket. The target tank would have been only a short distance away from this position.

swarmed over the sides and rear. The first thing to do was blind the tank's vision devices, often simply by spreading a blanket over them, though some squads used paint. The second thing was to disable a tank from further movement. With the generally light tanks of the early war period this was not as difficult as it sounds, for most tank tracks could be relatively easily broken by ramming a brick into the drive sprockets or even by levering them off with a heavy crowbar. If that failed a grenade would usually do the job. Once the tank was immobilized the squad could then finish off the job with whatever its members had to hand. That usually meant petrol or some other inflammable liquid being poured all over the engine covers or turret and then ignited, with horrible results for the hapless crew.

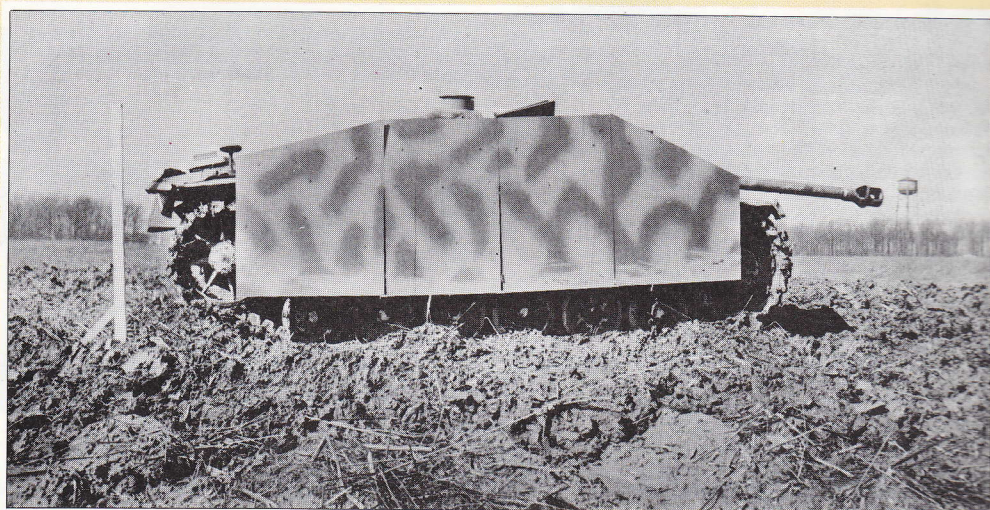
The importance of cover

These simple tactics were followed by tank-killer squads all through World War II, and were used by combatants both regular and irregular. Of course it was not always as easy as outlined above, for 'tankies' of all nations soon learned not to operate in isolation from other tanks that could provide both visual cover and supporting fire, or to move into areas where tank-killer squads were likely to be lurking. But there were times when tanks had to venture into built-up areas or close country, and when they did they learned to move only with the support of infantry that could tackle the killer squads. This often slowed down the progress of armoured formations but it was a process that had to be followed if the tanks were to survive.

Stand-off-weapons

The tank-killer squads did not simply melt away when these defensive measures were adopted by the tanks; they remained in being but came to rely more on stand-off weapons. By about 1942 the first of these infantry stand-off weapons, such as the PIAT and the bazooka, were being issued; the Germans already had the potent Panzerwurm mine. These the squads could use at close ranges from under cover, but the close-contact tactics were never entirely abandoned. There were always occasions when an enemy tank approached too close for its own safety and the old 'swarming' methods could be used, but as the war progressed the heavier tanks were not so easy to disable by the earlier rough methods. The tanks had to be halted by using explosives rather than by levering off a track, and at times no attempt was even made. The use of hand-held hollow-charge devices placed against the tank armour by magnets began to proliferate, forcing the Germans to coat their armoured vehicles in a plaster-like substance known as *Zimmerit* to prevent magnets from adhering. The British 'Sticky bomb' was one odd method of producing a similar result, but was a blast weapon alone, and by about 1942 the hollow charge that could be simply placed against a target tank was the most common tank-killer weapon. A standard Soviet ploy was to introduce small hand grenades into tank engine exhaust pipes. The PzKpfw V Panther was very vulnerable to this ploy when it was first introduced, and was only saved from even greater casualties by the welding of bars across the exhaust pipes to prevent the grenades from being introduced in the first place.

Perhaps the easiest kill of all so far as the tank-killer squads were concerned was the massive German Elephant self-propelled anti-



tank gun that went into action at Kursk in 1943. This powerful vehicle may have been a superb Panzerjäger, but it had no weapon at all other than its 8.8-cm (3.46-in) main gun. It carried no close-in defensive machine-gun, and the Soviet tank-killer squads could thus swarm all over the vehicles with virtual impunity and disable them at their leisure. Nearly all the Elephants that went into action at Kursk were disabled by these squads on the very first day they were used. Later versions had machine-guns hurriedly added.

By 1945 the German Panzerfaust had been added to the tank-killer armoury and all manner of specialized close-range tank killer weapons had been evolved. Various types and sizes of magnetic charges were commonplace, and the satchel charge had been added to the anti-tank armoury in a rather spectacular way

Many German AFVs such as this Stug III carried side-mounted 'Schützen' (skirts) to ward off the worst effects of enemy hollow charge projectiles. The thin, mild steel plates set off the warheads some distance from the main hull so that their fire jets would cause minimum damage to the hull.

by the suicidal Japanese. The lunge mine, which was originally a combat engineer weapon for demolishing strongpoints, had also been added to the inventory although most nationalities attempted to use it in a far safer manner than some of the more fanatical Japanese exponents.

Conclusion

Despite recent advances in anti-tank weapons and techniques, the tank-killer squad is still a military fact. They were used to good effect in conflicts such as the Korean War and during some of the Middle East wars, and in guerrilla-based conflicts such as that in Vietnam they are a virtual fixture. But in the main their tactics are not much removed from those almost desperate measures practised by the Home Guard back in 1940.

A formidable team of Red Army anti-tank riflemen make their way across a water obstacle. The rifles appear to be 14.5-mm (0.57-in) PTRD 1941s, the most widely used of the Soviet anti-tank rifles. They were normally used by the two-man teams seen here, one man firing and one man loading.





UK

Northover Projector

In the aftermath of Dunkirk the British army was left with virtually no anti-tank weapons available in any quantity other than grenades and a few 2-pdr anti-tank guns. With invasion imminent there was a need for an easily-produced weapon that could be used to arm not only the army but the newly-formed Local Defence Volunteers, later to become the Home Guard. One of the weapons that was rushed into production was the Northover mortar, also known as the bottle mortar but later designated the **Northover Projector**. The Northover was typical of the British 'pipe guns' of the period, and was produced very quickly and cheaply indeed.

The Northover Projector was little more than a steel pipe with a rudimentary breech mechanism at one end. The ammunition consisted of orthodox hand and rifle grenades that were propelled from the muzzle by a small black-powder charge. Later the glass bottle No. 76 phosphorus grenade was fired, and this gave rise to the name bottle mortar. There was no recoil mechanism since all recoil forces were absorbed by the projector's four-legged mounting: the legs were simple tubes and were easily produced. The sights were very basic but were accurate enough up to about 91 m (100 yards), and the maximum range was about 274 m (300 yards).

The Northover Projector was a very rudimentary weapon and thankfully it never had to be used in action. During 1940 and for some time afterwards it was a standard Home Guard weapon, and it was also issued to many army units for a while to provide them with at least some form of anti-tank weapon. In practice the Northover was only as good as the projectiles it fired, and as these were orthodox hand or rifle grenades their efficiency against most tanks was doubtful. The use of the white phosphorus bottle grenades would no doubt have been more successful, but this was not a popular weapon with the projector crews for the simple reason that the glass bottles often broke inside the barrels as they were fired, with obvious and highly unfortunate results. The usual crew for a projector was two men, with possibly another in charge of the weapon and for designating targets. Many Home Guard units introduced their own local modifications to enable the Northover



The Northover Projector was a 1940s weapon produced to equip the Home Guard. It was supposed to be used as an anti-tank weapon to fire the No. 76 bottle grenade filled with phosphorus. There was no recoil mechanism as the frame carriage was supposed to absorb the recoil, and the propelling charge was black powder.

to be moved around more easily. These included such measures as carrying the projector on simple handcarts to mounting the projector barrels on motorcycle sidecars. There were even some mounted on simple artillery-type carriages. In order to make the normal four-legged carriage easier to handle, a lightened **Northover Projector Mk 2** version was introduced during 1941, but by that time the urgent need for pipe guns such as the Northover had begun to wane and relatively few of these carriages were produced.

Very few Northover Projectors appear to have survived the war years but from time to time the glass phosphorus grenades still emerge from their war-time hiding places.

Specification

Northover Projector

Calibre: 63.5 mm (2.5 in)

Weights: projector 27.2 kg (60 lb);

mounting 33.6 kg (74 lb)

Range: effective 91 m (100 yards); maximum 274 m (300 yards)



An enterprising Home Guard unit from Sussex mounted their Northover Projector on this small hand cart, and are seen optimistically using it as an anti-aircraft weapon, a role for which it was entirely unsuited. The range was far too short and the muzzle velocity of the glass grenade much too slow.



UK

Boys anti-tank rifle

The **Rifle, Anti-tank, 0.55-in, Boys, Mk 1** was originally known as the **Stanchion Gun**, but the name was later changed to honour the name of its principle designer after he died just before the weapon entered service. It was designed to be the standard infantry anti-tank weapon of the British army, but it was soon overtaken by events and had only a short active career. The first of the type entered service during the late 1930s and by 1942 the weapon was obsolete, overtaken by rapid increases in enemy tank armour that the Boys rifle could no longer tackle.

The Boys anti-tank rifle had a calibre of 13.97 mm (0.55 in) and fired a powerful cartridge that could penetrate 21 mm (0.827 in) at 302 m (330 yards). The cartridge produced an equally powerful recoil, and this did

little to endear the weapon to its firer. To reduce this recoil somewhat the long slender barrel was fitted with a muzzle brake. Ammunition was fed into the bolt-action firing mechanism from an overhead five-round box magazine. Overall the Boys was rather long and heavy, which made it an awkward load to carry, so it was often mounted as the main weapon on board

A French officer is about to receive the hefty recoil from a Boys anti-tank rifle. The French army used a number of these rifles in 1940, provided by the British in exchange for a number of 25-mm (0.98-in) Hotchkiss anti-tank cannons. This example is the original Mk 1 with the monopod supporting leg.



Boys anti-tank rifle (continued)

Bren Gun or Universal Carriers. More were used as the main armament of some light armoured cars.

The first production Boys anti-tank rifles used a forward-mounted monopod combined with a handgrip under the butt plate. After Dunkirk various modifications were made to speed production, and among the measures taken was replacement of the forward monopod by a Bren Gun bipod and of the circular muzzle brake attachment by a new Solothurn muzzle brake with holes drilled along the sides; this latter was easier to produce than the original. In this form the Boys saw out its short service life, as by late 1940 it was regarded as being of only limited use as an anti-armour weapon. Eventually it was replaced by the PIAT, but before it finally departed it had a brief flurry of popularity during the Eritrean and Cyrenaica campaigns of 1940 and 1941. It was found to be a very effective anti-personnel weapon during these campaigns as it could be fired at rocks over or near a concealed enemy, the resultant rock splinters acting as effective anti-personnel fragments. The Boys also found its way into US Marine Corps hands during the Philippines campaign of early 1942, when some were used very sparingly against dug-in Japanese infantry positions. How these Boys rifles got to the Far East is not recorded. Some captured Boys anti-tank rifles were also used by the Germans for a short while after Dunkirk, but only in limited numbers; the type was known as the 13.9-mm Panzerabwehrbüchse 782(e).

In 1940 there were plans to produce a Mk 2 version of the Boys. This would have been a shortened and lightened version for use by airborne forces but it did not get very far before the project was terminated, no doubt because the shortened barrel would have produced an even more violent recoil.

Specification

Boys Mk 1

Calibre: 13.97 mm (0.55 in)

Lengths: overall 1.625 m (5 ft 4 in);

barrel 0.914 m (36 ft 0 in)

Weight: 16.33 kg (36 lb)

Muzzle velocity: 991 m (3,250 ft) per second

Armour penetration: 21 mm (0.827 in) at 302 m (330 yards)



The two service versions of the Boys anti-tank rifle were the Mk 1 (above) and the generally simpler Mk 1* (below). The Mk 1* was introduced to speed production, and had a simpler muzzle brake and a Bren Gun bipod, plus some other slight changes.



An armorer services a Boys anti-tank rifle Mk 1, easily recognizable from its monopod and circular muzzle brake. These rifles were little used after 1941 as they could penetrate only the lightest enemy armour, yet they were awkward to carry and when fired had a recoil that was best described as fearful.

INTERNATIONAL

Molotov cocktail

The Molotov cocktail appears to have had its operational debut during the Spanish Civil War of 1936-9, when it was first used against Nationalist tanks by the Republican forces. From these beginnings the Molotov cocktail soon became used by most nations as it was an easy weapon to produce and use, by forces both regular and irregular.

The basic weapon known as the Molotov cocktail is simply a glass bottle containing petrol (or some other inflammable substance) with an oil-

The Molotov cocktail was an international weapon, and shown here from the left are examples from the Soviet Union, (the second an 'official' Red Army version), Britain (using a milk bottle), Japan and Finland. All use the same basic simple form, with petrol soaked rags to act as fuses for ignition.



Molotov cocktail (continued)

soaked rag or something similar around the neck. This rag is ignited immediately before the weapon is thrown at a target, the breaking of the bottle as it hits its target allowing the contents to be ignited. It is all very simple, easily understood and easily used. The snag was that it was not very efficient. If the bottle smashes against the side armour or turret of a tank the results can be spectacular but not very harmful to the vehicle or its occupants. The only way to ensure damage is to detonate the bottle bomb over or near the engine louvers or perhaps the vision devices. It was also discovered early on that petrol alone was not a very efficient anti-armour weapon as it simply runs off the sides of a tank even as it was burning. In order to make the flame-producing mixture 'stick', the petrol had to be mixed with a thickening agent such as diesel or oil or in some cases various forms of latex. These niceties tended to move the Molotov cocktails out of the realms of the street fighter and into the domain of the regular soldier, and after 1939 the bottle grenade or bomb was used by many regular forces. The Finns were

British troops train with Molotov cocktails during 1940. The British Army referred to these weapons as 'bottle bombs' and even established production lines for them, often using milk bottles filled with petrol and phosphorus.

early exponents in their battles against the Soviet invaders of 1939-40, and after Dunkirk the petrol bomb was a weapon much used by British army units defending the United Kingdom. Later on, Soviet partisans made the Molotov cocktail their own particular weapon, but it was also used by regular Red Army forces. Many underground militias found the weapon easy to make and use.

An offshoot of the glass petrol bomb was the phosphorus grenade, used by several nations. This was designed as a smoke grenade, but the burning white phosphorus, which started to burn as soon as it was exposed to the air, also made it a very useful anti-personnel and anti-armour weapon. There were several of these types of grenade but typical was the British **Grenade, Self-Igniting, Phosphorus,**



No. 76. This was a glass milk bottle with a pressed-on cap (containing a mixture of phosphorus, water and benzine) and was intended primarily for the anti-tank role. It could be thrown at its target or launched from the Northover Projector, and contained a piece of smoked rubber that gradually dissolved in the mixture to make it 'stick' better to its target. Each No. 76 gre-

nade weighed about 0.535 kg (1.18 lb). It cannot be said that these phosphorus grenades were weapons popular with either the users or the recipients. They were the cause of frequent accidents in transit or use, and in the United Kingdom many were buried or hidden away when their fillings became unstable. Many are still discovered in their wartime caches to this day.



UK/USA/USSR

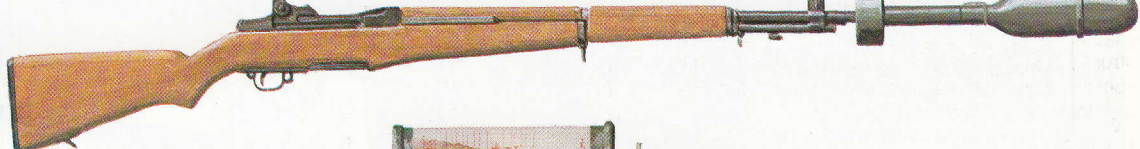
Anti-tank grenades

The British army used three types of anti-armour hand grenade. The first was the **Grenade, Hand, Anti-tank, No. 73**, known as the 'Thermos' bomb from its shape and size. It was a pure blast weapon which often had little effect on armour, so it was mainly used for demolition work. More common during the early war years was the infamous **Grenade, Hand, Anti-tank, No. 74 (ST)**, the 'Sticky bomb' which was coated in a gooey adhesive to make it stick to the side of a tank after landing. Normally the sticky surface was contained within two shell halves which were removed just before throwing. The No. 74 was a most unpopular weapon as the sticky substance tended to make it stick to anything, even before throwing, and the type was used as little as possible.

The best of the British anti-tank grenades was the **Grenade, Hand, Anti-tank, No. 75** otherwise known as the **Hawkins Grenade**. It was intended to be either thrown or laid as a mine to blow off a tank's tracks. It used a crush igniter fuse and about half of its weight of 1.02 kg (2.25 lb) was made up of the bursting charge. The type was often used in clusters for better effect, and the Germans captured so many of them before Dunkirk that they were later used as part of the minefields defending the Atlantic Wall with the designation Panzerabwehrmine 429/1(e).

The **Grenade, Rifle, Anti-tank, No. 68** was a rifle grenade fired from a muzzle cup fitted to the No. 1 Mk III rifle. It was withdrawn after 1941 as it was not much use against anything other than very light armour. It weighed 0.79 kg (1.75 lb) and could also be fired from the Northover Projector.

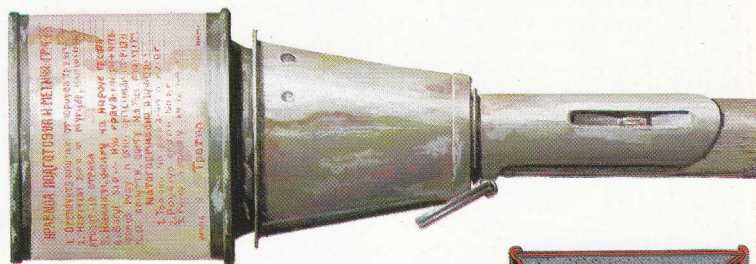
The American equivalent of the No. 68 was the **Antitank Rifle Grenade M9A1**, a much more successful grenade that could be fired from an M7 launcher fitted to the M1 Garand rifle or an M8 launcher fitted to an M1 Carbine. The M9A1 grenade weighed 0.59 kg (1.31 lb) and had an 0.113-kg (0.25-lb) warhead behind a thin steel



The American Anti-tank Rifle Grenade M9A1 could be fired from a muzzle attachment fitted to the M1 Garand rifle to a range of about 100 m (109 yards). Its hollow charge warhead could penetrate up to 101 mm (4 in) of armour. It could also be fired from the M1 carbine using the M8 launcher.

metal nose fitted with an impact fuse. Its capability against tanks was somewhat limited, but it was retained in service for some time as it was a very useful weapon against targets such as pillboxes. A ring tail was used for in-flight stabilization.

As with the anti-tank rifle, the Soviets tended to neglect the anti-tank grenade and had to rush something into service in rather a hurry in 1940. Their first attempt was the **RPG 1940**, which resembled a short stick grenade and relied mainly on blast for its effect; it was not a great success and was gradually replaced. The contemporary **VPGS 1940** was a rifle grenade which featured a long rod that fitted into the rifle barrel before firing. It too was no great success. The best of the wartime Soviet anti-tank grenades was the **RPG** introduced in 1943. This was a hand-thrown grenade which in some ways followed the example of the German Panzerwurfmine, but had a tail unit that trailed on two canvas strips to keep the warhead with its hollow charge pointed towards the target. The RPG weighed 1.247 kg (2.75 lb), and was thus quite a weight to throw, but it had a heavy explosive content and could be very effective. The RPG was retained in service for some years after 1945, and is still used by some Soviet-influenced armed forces.



Above: The RPG 1943 was the Soviet equivalent of the German Wurfmine, but it used a fabric strip stabilizer tail to keep the hollow charge warhead pointing towards the target tank when in flight. The tail was ejected from the throwing handle after the grenade had been thrown and after the arming pin had been removed.



Below: The Soviet RPG-6 was a late-war version of the RPG 1943. It used a revised warhead shape and four fabric tails to stabilize the warhead in flight. The revised warhead also had a good fragmentation effect, so it could be used as an anti-personnel weapon. It was used for many years after 1945.

Warsaw Pact

Czechoslovakia

Part 3



Czechoslovakia was occupied by the Germans before World War II, and was subsequently liberated by the Soviet Union. After the war Czechoslovakia tried to become a democratic country once again, but by 1948 the country was firmly in the Soviet camp. Attempts for a more liberal society under the leadership of Alexander Dubcek led to the Soviet invasion of August 1968, and this was immediately followed by a return to the rigid Communist system of other countries in the Soviet bloc.

Czechoslovakia is also the home of the Soviet Central Group of Forces, whose headquarters are in Prague. This controls two army HQs, three motorized rifle divisions (the 16th, 55th and 66th) and two tank divisions (the 10th and 31st), one artillery brigade, three surface-to-surface missile brigades and an air-assault battalion.

The Czech decision to form air and land forces along Soviet lines was taken in 1945, although Czech units fought the Germans on the Eastern Front as early as 1943. In the immediate post-war period little progress was made because of tension between the Czech and Slovak elements, who mistrusted each other as many of the latter were pro-Soviet. This situation was much improved in the 1950s, and in 1955 Czechoslovakia became one of the first members of the Warsaw Pact. When the Soviet Union invaded Czechoslovakia in August 1968 the Czech armed forces offered no resistance.

Today the Czech armed forces have a total strength of about 207,000 officers and men, of whom 118,000 are conscripts. In the army conscripts serve two years while in the air force they

serve three years. The ground forces and the air and air defence forces come under the Ministry of Defence while the frontier guards (the PS) and the internal guards (the VS) come under the Ministry of the Interior. The PS has a strength of about 11,000 men and in time of war would form seven brigades whose equipment would include tanks and anti-tank weapons. In addition there is a People's Militia with a strength of 120,000.

Czech Army

The army has a total strength of about 148,000 officers and men, of whom 100,000 are conscripts. Reserves total some 495,000, of which 200,000 are in the immediate reserve. There are two military districts, five tank divisions (the 1st, 4th, 9th, 13th

and 14th), five motorized rifle divisions (the 2nd, 3rd, 15th 19th and 20th) and one artillery division (the 22nd). The latter has two anti-tank regiments, three 'Scud' surface-to-surface tactical missile regiments (with nuclear warheads under Soviet control) and two conventional artillery brigades. There is also one airborne brigade. All Czech units are organized along Soviet lines, and in time of war would probably rely heavily on Soviet logistic support.

The Czech army uses more indigenous equipment than any other Warsaw Pact nation. This is the M59 82-mm recoilless anti-tank gun, which fires a fin stabilized HEAT round to a maximum effective range of 1200 m (1312 yards). Now obsolescent, it is the only Warsaw Pact gun to use a ranging rifle.



Below: A Czech T-55 is seen on joint Warsaw Pact manoeuvres just a few weeks before Soviet forces invaded, in August 1968. The Czech army wisely offered no resistance during the attack, but its non-cooperation in the years following was in the best Czech tradition.



Armed Forces of the World

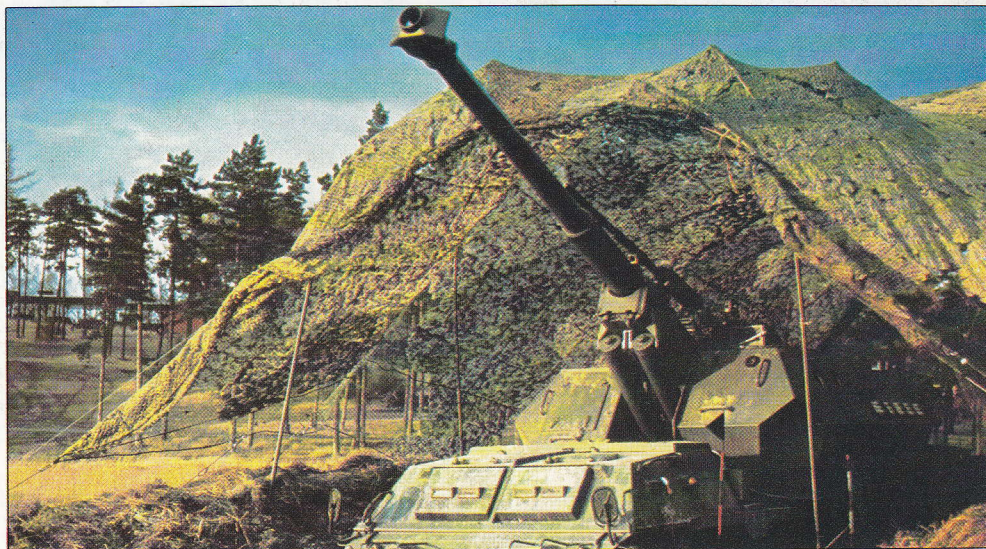


Equipment includes 3,500 T-54/T-55 and T-72 MBTs (the former basic type being far the more common at present); 1,000 BMP-1 mechanized infantry combat vehicles; 2,600 OT-62, OT-64 and OT-810 armoured personnel carriers and their variants; and 1,000 BRDM-1 4x4 and OT-65A 4x4 reconnaissance vehicles. Self-propelled anti-tank vehicles include the BRDM-2 with 'Sagger' ATGWs and the OT-810 with recoilless rifles. Self-propelled artillery weapons include the 122-mm (4.8-in) 2S1 and 152-mm (6-in) DANA, while towed artillery weapons include 250 M53 100-mm (3.9-in) field guns, 250 M52 85-mm (3.35-in) field guns, 80 130-mm (5.12-in) M46 field guns, 110 122-mm M1931/37(A-19) guns, 100 152-mm M1937(ML-20) gun/howitzers, at least 250 122-mm D-30 and 122-mm M1938(M-30) howitzers. Multiple rocket-launchers include 200 122-mm M1972(40-round) and about 120 older 130-mm M51(32-round) systems. Surface-to-surface missiles include 40 FROG-7 and 27 'Scud' launchers. ATGWs include the AT-3 'Sagger' and AT-4 'Spigot', plus many light anti-tank weapons and recoilless rifles. Almost all small arms used by the army are made in Czechoslovakia.

There are some 600 anti-aircraft guns in service, including 23-mm ZU-23 and 57-mm S-60 towed and 30-mm M53/M59 and 23-mm ZSU-23-4 self-propelled systems. SAMs include the SA-4 'Ganef', SA-6 'Gainful', SA-7 'Grail' and SA-9 'Gaskin'.

There are many older weapons in reserve or used for training, these including the T-34/85 tank, and the 152-mm M18/46 and 105-mm (4.13-in) M18/47 towed howitzers.

Czechoslovakia is self-sufficient in many army weapons and is also the leading exporter of army equipment in the Warsaw Pact outside the Soviet Union. For many years it has produced the T-55 MBT, and is now tooling up for the T-72 MBT. In place of the Soviet BTR-60 series of 8x8 armoured personnel carriers Czechoslovakia and Poland use the Czech-built OT-64, which is a superior vehicle in many respects and is also widely exported. More recently Czechoslovakia has designed an 8x8 152-mm self-propelled gun called the DANA, which has



Czechoslovakia produces its own self-propelled 152-mm howitzer, the DANA. Based on the chassis of the Tatra 815 8x8 truck, it entered service in 1981. The Tatra has a respectable cross-country ability and centralized tyre pressure regulation.

already been exported to Libya. The 122-mm M1972(40-round) rocket-launcher on a Tatra chassis has also been exported in some numbers.

Czech Air Force

The Czech air force has a strength of about 59,000 men, of whom 18,000 are conscripts, and a front-line strength of 450 aircraft. There are 10 squadrons of ground-attack aircraft, three of them with Sukhoi Su-7, three with the Mikoyan-Gurevich MiG-23, three with MiG-21 and one with MiG-15. There are 18 fighter interceptor squadrons with MiG-21s (which can also be used in a ground-support role), three reconnaissance squadrons (two with MiG-21s

and one with Aero L-29s), two transport regiments and one helicopter regiment. The latter has about 40 Mil Mi-1, 20 Mi-2, 100 Mi-4, 10 Mi-8 and 30 Mi-24 helicopters. Training aircraft include the Czech built L-29, Aero L-39 and Zlin 526. Over 3,600 L-29 jet trainers were built between 1963 and 1974, and this important type was replaced in production by the L-39 Albatros, which is also used by other countries including Afghanistan, Cuba, Ethiopia, Iraq, Libya, Romania, Syria, the USSR and Vietnam.

The air force also controls three air-defence divisions with some 250 SA-2 'Guideline' and SA-3 'Goa' launchers at 40 sites. Reserves amount to some 30,000 men.

The Czech air force is still equipped mainly with MiG-21s, and is split into two commands: the 7th Air Army, which is responsible for national air defence, and the 10th Air Army, which is directly subordinate to the Soviet army.

